Ohio Department of Agriculture
2011 Final Report
12-25-B-1248
Specialty Crop Block Grant Program

CONTACT

Program Contact: Lori Panda, Senior Program Manager, Marketing Division

Phone: 614.466.8798 E-mail: panda@agri.ohio.gov

Date Submitted: December 9, 2014 **Date re-submitted:** December 19, 2014

CONTENTS

Project Title: Ohio Grocers Foundation (OGF) Pathway to Food Safety

Project Summary:
This project was a collaboration of Ohio State University Extension, Family and Consumer Sciences; Ohio State University Office of College Communications (College of Food, Agricultural, and Environmental Sciences), and the Ohio Grocers Foundation.

The objective of this project was to update the 1990s-era Pathway to Food Safety training modules for grocery store employees to reduce the risk of foodborne illness and include a new module to ensure the safety of local produce that Ohio Grocers members purchase from local farmers, or produce that is sold at a Farmer's Market. This project included a specific lesson on Food Safety Management for Locally Produced Specialty Crops. The retail food industry has seen a major trend over the past few years with consumers demanding more local products. As result, grocery stores have increased the number of locally produced specialty crops they purchase from local farmers and sell in their stores. As a result, our member grocery stores have increased the number of locally produced specialty crops they purchase from local farmers and sell in their stores. The concern for our member grocery stores, as well as for the consumers is the safety of these locally produced specialty crops. The training modules educated retailers on how to purchase local specialty crops from local farmers.

Project Approach:
The initial meeting of the partners on the project was to review the current Pathway to Food Safety Training videos and curriculum. All scripts for the videos were revised, as well as the written materials. A new video script was developed for the Locally Produced Specialty Crops lesson. The entire program was updated and rebranded with new logos and designs. All the video shoots took place in the summer/fall of 2012, with the final video shoot for the Specialty Crops lesson happening in early 2013. Grant funds were not used to fund the promotion of the kit, and specifically specialty crops. The Ohio Grocers Foundation and OSU did marketing of the kit, but it was outside the grant funds. The Ohio Grocers Foundation promoted on Facebook pages, and through email blasts. A specific email was also created, as well as a promotional flyer, highlighting the specialty crops module. The Ohio State University Office of College Communications coordinated all the video shoots by securing the venues, props and talent. There were seven videos produced on the following topics: Introduction to the program, Personal Hygiene, Hand Washing, Preventing Cross Contamination, Cleaning and Sanitizing, Managing Time and Temperature, and Locally Produced Specialty Crops. A manual was also developed with a lesson on each of the video topics. The materials also included Management Training Materials, Resources - OSU Extension Fact Sheets on Food Safety, including Local Produce. The program was pilot tested to 10 grocers and other experts in the field in April 2013. The project was completed in July 2013 and promotion for the program began at that time. The Pathway to Food Safety program was promoted to all Ohio Grocers members via website, social media, customized email blast, and Weekly Checkout (mass email to over 1500 people). The Ohio Grocers Foundation created a promotional flyer and developed web banners. The Foundation also promoted the program in the quarterly OhioGrocer magazine and at the Ohio Grocers Association's Fall Conference in 2013. The Ohio State University Extension marketed the program and promoted at two workshops with specialty crop producers. The program was marketed on the e-Store at The Ohio State University.

Goals and Outcomes Achieved:
The main objective was to increase awareness of specialty crop food safety and local specialty crops by promoting the program to local growers, grocers and farmers markets. As stated in the Project Approach, the program has been marketed and promoted to all the identified groups. Initially, when writing the grant, the thought was to sell the entire kit to farmers and Farmer's Markets. After producing the grant, it was determined that the farmers and Farmer's Markets were just interested in the Locally Produced Specialty Crops module, so the OSU Extension Educators shared the Specialty Crops module at several programs and gave the You Tube Video link to all participants. As reported, that was a total of 104 participants at two Farm to School Programs. These programs allowed partnerships between farmers and school food service departments. Also, the Specialty Crops Module was shared in September 2014 at a National Extension Educators program. Due to the farmers not purchasing the kit, evaluations were not conducted. One measurable objective was to survey (evaluate) farmers who purchased the program and determine if they understand food safety practices. After completion of the program, it was determined that local growers and producers could be made aware of the Specialty Crops lesson by attending educational workshops provided by Extension Educators. Fifteen OSU Extension Educators are using the program in the state of Ohio, and 104 participants were trained specifically in Specialty Crop Food Safety at Farm to School programs in the state.

The second measurable objective was to increase awareness of specialty crop food safety by promoting the program to Ohio Grocers' retail members. In the past year, the Pathway to Food Safety program including the Locally Produced Specialty Crop lesson, has been purchased by four companies with outreach to 37 grocery stores across Ohio. As noted in the Annual Report and in the previous outcomes, the entire kit was promoted to all Ohio Grocers retail members in many ways. In the first year, four (4) were sold to companies with a total of 37 grocery stores. There was not an increase of 100% in sales from the total of the past three years. The kit will continue to be promoted to Ohio Grocers retail members, as well as through OSU Extension Educators and through the Ohio State University e-store.

Long term goal: The Pathway to Food Safety program will be available and relevant to grocers, producers and farmers for many years to come. The program will continue to be monitored and evaluated.

Beneficiaries:
Direct beneficiaries were grocers, producers and farmers who were educated on the importance of food safety with locally produced specialty crops.

April 29, 2014 – Perrysburg, OH	Farm to School Program	58 participants
April 30, 2914 – Mt. Orab, OH	Farm to School Program	46 participants
July 2013 – December 2014	Ohio Grocers	37 stores
July 2013 – December 2014	YouTube Video – Food Safety for Locally Produced Specialty Crops	105 Views
July 2013 – December 2014	OSU Extension	15 Educators
August 2013	Evaluation of Program	20 stores (Ohio Grocers

		members)

Lessons Learned:
The Locally Produced Specialty Crops module is a valuable tool for grocers, farmers and Farmer's Markets and should be readily available to share, without cost, to interested parties. As learned from the development and implementation of the module, farmers are mainly interested in Food Safety as it relates to Specialty Crops and are familiar with getting their educational materials and trainings at no cost from OSU Extension Educators. It was a good decision to have the Specialty Crops module as a separate educational piece, including a You Tube link, available for farmers at no cost.

There were some factors that impacted the marketing/selling of the Pathway to Food Safety program. The Ohio Department of Health changed the rules for Food Safety training so the program was not able to be certified as Level One Food Safety training. Also, the thought was that the Food Safety Modernization Act (FSMA) would identify specific food safety rules for produce growers and the Pathway to Food Safety Locally Produced Specialty Crop lesson would be a good resource for that audience. However, the FSMA is still being discussed and has been delayed for nearly two years.

Contact Person:
Tonya Woodruff
Director, Ohio Grocers Foundation
1335 Dublin Rd, Suite 30A
Columbus, OH 43215
614-448-1631
foundation@ohiogrocers.org

Additional Information:
Pathway to Food Safety program – enclosed (DVD and CD)

You Tube Video Locally Produced Specialty Crops -
https://www.youtube.com/watch?v=QIB2C6_FE3I

Project Title: Revitalization, Expansion and Season Extension of Blueberry Production in Ohio

Project Summary:
The lead organization of this project was Ohio State University South Centers, 1864 Shyville Road, Piketon, OH 45661. The industry partners were Ohio Produce Growers and Marketers Association (OPGMA), 17 South High Street, Suite 200, Columbus, OH 43215, and 280 North High St, 6th floor, Columbus, OH 43215.

An applied research program on new cultivars, plant propagation, plant establishment, and season extension with high tunnels was conducted at OSU South Centers in Piketon. A new

blueberry cultivars "Draper" had stood out as a very good new cultivar for Ohio and many growers had planted it. There was also good consumer acceptance. High tunnels promoted early ripening while the yields were relatively low in 2012 and did not promote early ripening when yields were at record high in 2013. A comprehensive extension program was developed and delivered in 2012 and 2013. Presentations, workshops, grower visits, emails, phone consultations, and press releases, websites, and social media were all utilized in outreaching and educating growers. Approximately 950 growers were reached during the two-year span of this project. We helped growers diagnose problems, select new cultivars, improve production techniques, and reduce wildlife damage. An award-winning extension publication, which is entitled Midwest Blueberry Production Guide, was written and published as a result of the project. Around 2,500 copies of the bulletin were printed. The bulletin has served as a useful guide for all blueberry growers in Ohio and beyond. A spring freeze reduced yields in 2012. However, record yields were achieved by blueberry growers across the state in 2013. Improved production and marketing techniques in conjunction with favorable weather conditions helped blueberry growers improve their total yields from 20% to 150% in 2013. An estimated 50 acres of new blueberry plantings have been added in Ohio since 2007. Quite a few new growers entered blueberry production while existing growers expanded their planning in 2012 and 2013. Our research and extension efforts had been very helpful to fruit growers in Ohio.

The major issues that Ohio blueberry growers face today were severely limited acreage in production, drastic yield loss from declining fruit-bearing plants, limited data on new blueberry cultivars, lack of information on high tunnel production and nursery production, and inadequate technical support to growers. This project was designed to evaluate new and superior blueberry cultivars, increase the acreage of commercial blueberry production, improve production and marketing skills of commercial blueberry growers, and develop blueberries as a new nursery crop in Ohio. Existing blueberry growers needed to plant new cultivars as their existing plantings age and deteriorate. They also needed to know what the best cultivars to plant when replanting. New blueberry growers must learn site selection, cultivar selection, plant establishment, soil and water management, effective pest management, and marketing methods. High tunnels were used to help producers increase the profitability of blueberry production. Nursery production of blueberry plants was investigated as way a for growers to make money. The funding for this research was very critical and timely since gross receipts from blueberries can be $16,000 or more per acre. Results from this research project were expected to help fruit growers greatly expand their production and increase their profitability!

Project Approach:

Research Projects: High tunnel blueberry production for season extension and yield enhancement, new blueberry planting establishment, new cultivar trial, and nursery propagation production techniques were conducted at OSU South Centers in Piketon from 2011 to 2013.

Educational Programs: Educational programs were offered at OSU South Centers in Piketon (southern Ohio), The Blueberry Patch in Mansfield (Central Ohio), and Baumhart Berry Farm in Vermillion (Northern Ohio). Summer field days and research tours were offered at OSU South Centers in Piketon, Ohio.

Presentations: In addition to presentations at the educational programs organized by Dr. Gary Gao, the project PI, he also presented research findings and shared production techniques with growers all over Ohio through OPGMA Congress and Summer Field Day and Tour, OSU's Farm Science Review, OSU Extension's Southwest Fruit and Vegetable School and Eastern Ohio Fruit and Vegetable Workshop.

Grower Consultations: Dr. Gary Gao met numerous growers all over the State of Ohio to help both new and existing growers with their production techniques and pest management. He has gone to all corners of the state from Cincinnati to Youngstown, from Marietta to Toledo, from Chillicothe to Cleveland.

Publications: Dr. Gary Gao wrote articles on blueberry production in growers magazine. He authored one chapter in a new Midwest blueberry production guide. He published one article on blueberry production in OPGMA Today, a quarterly magazine for Ohio Produce Growers and Marketers Association OPGMA). He was also interviewed by several reporters for articles on blueberry production.

Goals and Outcomes Achieved:

1. Common causes of blueberry decline in Ohio were determined through grower visits, pest and disease diagnoses, soil and plant tissue analyses.Instead of conducting a survey, Dr. Gary Gao made many personal visits to blueberry farms in Ohio and helped growers diagnose their problems. Fungal diseases, high soil and irrigation water alkalinity, and poor soil drainage were some of the the common causes of blueberry decline in Ohio.Common fungal diseases include Phytophthora root rot *(Phytophthora cinnamomi*), Botryosphaeria stem canker (*Botryosphaeria cortices*), and Botryosphaeria stem blight (*Botryosphaeria dothidea*). Phytophthora root rot was identified as a primary cause of decline in three blueberry farms. Total area affected was approximately 5 acres. Botryosphaeria stem canker and Botryosphaeria stem blight were extremely common in Ohio. These two diseases were confirmed on a very large planting after samples were sent to OSU's Plant and Pest Diagnostic Clinic. The affected area was more than 20 acres. High alkalinity in soil and irrigation water was identified as the main cause of decline in several blueberry plantings. Soil and water acidification was recommended to correct the problem. High soil alkalinity affected at least 150 acres of blueberry plantings in Ohio while high water alkalinity in water affects about 30 acres of blueberry planting. Poor soil drainage was identified as the primary causes of decline in many blueberry plantings in 2011. Excessive rainfall in April and May could have aggregated the problem. However, the spring rainfall amounts in 2012 and 2013 turned out to be at or below average.

2. Season extension study revealed that mature blueberry bushes in high tunnels ripened sooner than those in the open field under moderate yields in 2012. There was no significant difference in total yields between blueberry under high tunnels and in the open field. In 2013, blueberry fruits ripened at the same rate under high tunnel as those in the open field. This may have been a result of extremely high yields due to favorable weather conditions and extended bloom period and excellent fruit set. Major yield increase in high tunnels was not observed in our experiment. This does not necessarily mean that high tunnels do not increase blueberry yields. Lack of significant yield differences may have been due to insufficient time that blueberry bushes were placed under high tunnels. Much greater yield difference was observed by a researcher at

Kansas State University where blueberry bushes were placed under high tunnels at planting. The study lasted about 7 years. Greater yield different may have attributed to faster growth and larger bushes, which translated into more canes, more flower buds and more fruits in high tunnels.

Season Extension and Yield Boosting with High Tunnels:

Two high tunnels were placed over an existing 16 year-old blueberry planting. The blueberry cultivar is 'Blueray,' which was planted 15 feet between rows and 4 feet between plants. Each high tunnel covered two rows, one with drainage tile and other without drainage tile. Two uncovered rows of the same length served as control. Two replicates were also created within each treatment since we only had two high tunnels. Each treatment was subsampled into two plots, giving us two additional replications within each replication.

The experimental plot was laid out as follows:

Yield and berry soluble solids (sugar content) data were collected from June 12 to July 2, 2012. Treatments were high tunnel with tile (drainage), high tunnel without tile (drainage), open without tile (drainage) and open with tile (drainage). Since blueberries ripened during a period of 2 to 3 weeks, we harvested the berries as they ripened. The harvest dates were June 12, 15, 18, 20, 22, 25, 27, 29, and July 2, 2012.

The total yield of blueberries per bush was measured as the sum of nine harvests from June 12 to July 2. There was an overall trend of higher yields in high tunnels. However, there was no significant statistical difference (Table 1). This is probably due to the fact that the high tunnels were installed in March, 2012. Since blueberry plants develop their flower buds a year before, we would not have seen a significant yield increase during the first year.

Table 1. Total Blueberry Yields in 2012

Treatment	Marketable lbs./plant	Average Fruit Weight (grams)	Brix
High Tunnel With Tile	5.89 a	1.53 a	14.6 b
High Tunnel Without Tile	5.83 a	1.67 a	16.5 a
Open Without Tile	5.29 a	1.70 a	15.4 ab
Open With Tile	4.96 a	1.73 b	15.4 ab
LSD	1.75	0.17	1.6

There was a significantly higher yield from our first harvest on June 6 in high tunnels in comparison with open field either with or without tile drainage (Table 2.) This is consistent with

the fact that high tunnels promote earlier fruit ripening. There was also a higher soluble solid content in high tunnel without tile over open field with tile. Earlier fruit ripening typically gives growers an advantage in terms of pricing and marketing. Berry size was not significantly affected.

Table 2. Blueberry Yield on 6-6-2012

Treatment	Marketable lbs./plant	Average Fruit Weight (grams)	Brix
High Tunnel With Tile	0.86 a	2.13 a	15.2 b
High Tunnel Without Tile	0.98 a	2.24 a	17.6 a
Open Without Tile	0.46 b	1.98 a	16.3 ab
Open With Tile	0.31 b	1.87 a	14.6 b
LSD	0.37	0.85	2.27

During our second harvest on June 15, high tunnel plots had a higher yield than the open field with tile, but not open field without tile drainage (Table 3). There was no significant difference in berry size.

Table 3. Blueberry Harvest 6-15-2012.

Treatment	Marketable lbs./plant	Average Fruit Weight (grams)
High Tunnel With Tile	1.48 a	1.50 a
High Tunnel Without Tile	1.50 a	1.64 a
Open Without Tile	1.01 ab	1.62 a
Open with Tile	0.66 b	1.84 a
LSD	0.61	0.34

High tunnel plots with and without tile had higher yields than open fields with and without tile from our harvest on June 18 (Table 4). Soluble solid content was high in high tunnel without tile than open field with tile. High tunnels still had significantly promoted early ripening.

Table 4. Blueberry Harvest 6-18-2012.

Treatment	Marketable lbs./plant	Average Fruit Weight (grams)	Brix
High Tunnel With Tile	0.86 a	2.13 a	15.22 ab
High Tunnel Without Tile	0.98 a	2.24 a	17.55 a
Open Without Tile	0.46 b	1.98 a	16.15 a
Open With Tile	0.31 b	1.87 a	14.60 b
LSD	0.37	0.85	2.27

From June 20 to July 2, the yields of blueberry plants were not significantly different among all treatments (Tables 5-10). It seems that high tunnels promoted early ripening from June 6 to June 18 in 2012. The beneficial effects from high tunnels tapered off after June 18.

In summary, high tunnels promoted early ripening in blueberries and produce a more concentrated harvest even when the plants were covered in high tunnels for about 3 months.

Table 5. Blueberry Harvest 6-20-2012.

Treatment	Marketable lbs./plant	Average Fruit Weight (grams)
High Tunnel With Tile	0.75 a	1.42 b
High Tunnel Without Tile	0.77 a	1.62 ab
Open Without Tile	0.79 a	1.731 a
Open With Tile	0.67 a	1.79 a
LSD	0.23	0.23

Table 6. Blueberry Harvest 6-22-2012.

Treatment	Marketable lbs./plant	Average Fruit Weight (grams)
High Tunnel with Tile	0.61 a	1.76 a
High Tunnel Without Tile	0.57 a	1.67 a
Open Without Tile	0.71 a	1.76 a
Open With Tile	0.72 a	1.93 a
LSD	0.24	0.37

Table 7. Blueberry Harvest 6-25-2012.

Treatment	Marketable lbs./plant	Average Fruit Weight (grams)	Brix
High Tunnel With Tile	0.36 a	1.53 a	13.95 b
High Tunnel Without Tile	0.42 a	1.67 a	16.70 a
Open Without Tile	0.34 a	1.70 a	15.20 a
Open With Tile	0.53 a	1.62 a	17.79 a
LSD	0.44	0.17	3.15

Table 8. Blueberry Harvest 6-27-2012.

Treatment	Marketable lbs./plant	Average Fruit Weight (grams)
High Tunnel With Tile	0.22 a	1.36 a
High Tunnel Without Tile	0.14 a	1.45 a
Open Without Tile	0.31 a	1.56 a
Open With Tile	0.28 a	1.59a
LSD	0.27	0.34

Table 9. Blueberry Harvest 6-29-2012.		
Treatment	**Marketable lbs./plant**	**Average Fruit Weight (ounces)**
High Tunnel With Tile	0.16a	0.046a
High Tunnel Without Tile	0.13a	0.048a
Open Without Tile	0.21a	0.056a
Open Without Tile	0.19a	0.035a
LSD	0.18	0.022

Table 10. Blueberry Harvest 7-2-2012.			
Treatment	**Marketable lbs./plant**	**Average Fruit Weight (grams)**	**Brix**
High Tunnel With Tile	0.22 a	1.30 a	14.37 ab
High Tunnel Without Tile	0.12 a	1.53 a	14.91 ab
Open Without Tile	0.18 a	1.45 a	15.60 a
Open With Tile	0.29 a	1.50 a	13.54 b
LSD	0.30	0.26	1.95

Blueberry Yield and Fruit Quality Data in 2013

The berry yields in 2013 showed an interesting trend (Tables11-16). The yields were quite high across the board due to milder temperatures throughout the fruit ripening period.

With total yield for the season, the blueberry bushes under high tunnel without tile drainage produced 16.6 pounds of berries per plant or 12,069 pounds per acre, which is significantly higher than the yield from the high tunnel with drainage tile, open field with drainage (Table 11). There was no significant difference between the total yields in the high tunnel without tile drainage and the open field without tile drainage (Table 11).

Table 11: Total Season Yields at Piketon, Ohio				
Treatment	**Marketable lbs. per plant**	**Marketable lbs. per acre**	**Average Fruit Weight (grams)**	**Soluble Solids Content (Brix^{o})**
Tunnel with Tile	11.2 b	8,100 a	1.70 a	9.4 a
Tunnel without Tile	16.6 a	12,069 a	1.77 a	9.1 a
Open with Tile	11.5 b	8,338 b	1.79 a	8.0 b
Open without Tile	14.3 ab	10,343 ab	1.67 a	8.3 b
LSD	**4.7**	**3392.1**	**0.17**	**0.7**

*Treatments with different Letters are significantly different.

Table 12: Week One 6-27-2013			
Treatment	**Marketable lbs. per plant**	**Marketable lbs. per acre**	**Average Fruit Weight (grams)**
Tunnel with Tile	2.6 a	1898.4 a	2.30 a
Tunnel without Tile	4.1 a	2982.1 a	2.20 a
Open with Tile	3.0 a	2171.2 a	2.21 a

Open without Tile	3.4 a	2497.7 a	2.11 a
LSD	**2.00**	**1452.9**	**0.47**

*Treatments with different Letters are significantly different.

Based on our data in 2012 and 2013, the yield-boosting potential with mature blueberry bushed under high tunnel may or may not be evident with mature blueberry bushes. Commercial growers should not jump into high tunnel blueberry production in Ohio. They might consider planting young blueberry plants under high tunnel on a small scale. It is highly likely that blueberry bushes will grow much faster under high tunnel. Bigger plants should lead to higher yields. A few more years of data needed to be collected before solid conclusions can be made. In addition, blueberry plants needed to be covered in high tunnels since first year of planting. The yield data needed to be tracked for 7-10 years to gain a much more accurate view of the full benefit of high tunnels.

High tunnels without tile promoted ripening under a 'normal' to low fruit load." However, under extremely high fruit loads, i.e. 2013, fruits did not ripen any faster under high tunnel when compared to the open field.

Since this was a two-year grant, we only covered the mature blueberry bushes. It did not make sense for us to cover a new planting to collect total yields since fruit removal is a standard practice during the year of planting in commercial blueberry production. We could only have had fruit data for one season.

Table 12: Week One 6-27-2013

Treatment	Marketable lbs. per plant	Marketable lbs. per acre	Average Fruit Weight (grams)
Tunnel with Tile	2.6 a	1898.4 a	2.30 a
Tunnel without Tile	4.1 a	2982.1 a	2.20 a
Open with Tile	3.0 a	2171.2 a	2.21 a
Open without Tile	3.4 a	2497.7 a	2.11 a
LSD	**2.0**	**1452.9**	**0.47**

*Treatments with different Letters are significantly different.

Table 13: Week Two 7-5-2013

Treatment	Marketable lbs. per plant	Marketable lbs. per acre	Average Fruit Weight (grams)
Tunnel with Tile	2.9 b	2135.1 b	1.93 a
Tunnel without Tile	4.3 a	3092.6 a	1.98 a
Open with Tile	3.3 ab	2363.4 ab	2.02 a
Open without Tile	4.0 ab	2871.6 ab	1.97 a
LSD	**1.1**	**782.4**	**0.18**

*Treatments with different Letters are significantly different.

Table 14: Week Three 7-12-2013

Treatment	Marketable lbs. per	Marketable lbs. per	Average Fruit

	plant	acre	Weight (grams)
Tunnel with Tile	2.6 b	1906.9 b	1.77 b
Tunnel without Tile	3.7 a	2658.8 a	1.83 ab
Open with Tile	2.8 ab	2028.9 ab	1.94 a
Open without Tile	3.5 ab	2561 ab	1.84 ab
LSD	**1.0777**	**686.3**	**0.17**

*Treatments with different Letters are significantly different.

Table 15: Week Four 7-19-2013			
Treatment	**Marketable lbs. per plant**	**Marketable lbs. per acre**	**Average Fruit Weight (grams)**
Tunnel with Tile	2.0 b	1444.0 b	1.40 ab
Tunnel without Tile	3.0 a	2176.4 a	1.51 a
Open with Tile	1.8 b	1305.4 b	1.40 ab
Open without Tile	2.3 ab	1670.8 ab	1.38 b
LSD	**1.0**	**717.8**	**0.12**

*Treatments with different Letters are significantly different.

Table 16: Week Four 7-24-2013			
Treatment	**Marketable lbs. per plant**	**Marketable lbs. per acre**	**Average Fruit Weight (grams)**
Tunnel with Tile	1.0 ab	715.6 ab	1.45 ab
Tunnel without Tile	1.6 a	1158.8 a	1.54 ab
Open with Tile	0.6 b	469.3 b	1.62 a
Open without Tile	1.0 ab	742 ab	1.17 b
LSD	**0.7**	**499.6**	**0.43**

*Treatments with different Letters are significantly different.

High tunnels could still be a viable option for growers who wanted to extend the harvest season and increase the yields. They will need to install high tunnels during the first year and follow yield trends for 7-10 years to determine the full potential of high tunnels. In addition, frost protection and fruit quality improvement could also been additional benefits of high tunnels.

3. The feasibility of blueberry plants as a potential nursery crops was investigated through our propagation research. We collected hardwood cuttings from our mature blueberry planting of "Blue Ray" in March, 2012 and 2013. Stems were cut into 6" segments. Peat moss was used as the propagation media. Twelve inches of peat moss was placed in grape lugs. Cuttings were dipped in 'Rootone' first. They were then stuck into the peat moss with 3" of cuttings in the peatmoss and 3" above the peat moss. These cuttings were kept moist with an overhead misting system.The rate of success was about 60% in 2012 and the rate of success improved a little during our second try. We found out very quickly that nursery propagation of blueberry plants on a commercial scale was a highly specialized trade. A separate research project had to be specifically dedicated to refinement of propagation protocol to make it work. Production efficiency has to be improved drastically to make it economically viable option for a grower to get into the nursery business. This was beyond the scope our project. Fortunately, one blueberry grower in Mansfield has been propagating blueberry bushes for a few years and produced

300,000 blueberry plants each year on 2012 and 2013. Another wholesale greenhouse flower grower propagated around 7,000 plants each year in 2012 and 2013. They used two different propagation methods. These plants represented an economic impact of at least $2 million dollars. It should be noted that more effective marketing efforts are needed so that Ohio nursery growers can sell the plants for a decent profit.

4. Newly planted blueberry plants in our blueberry cultivar trial site at OSU South Centers will produce some fruit for evaluation. “Draper” stood out as an excellent new mid-season blueberry cultivar in our trial. We strongly recommend “Draper” for commercial planting in Ohio. So far, the feedback has been very mostly positive from both growers and consumers. Growers in Ohio have planted at least 10 acres of “Draper” blueberries since 2012.

A solid block of “Draper” blueberry bushes was planted in 2012 at OSU South Centers since “Draper” was shown to be a promising new blueberry cultivar in several key blueberry states. “Draper” has good flavor with good hardiness, produces a concentrated harvest, and can be machine harvested for both processing and fresh market. “Draper” has performed very well in our research plots at Piketon, Ohio. he average yield in our plot was one quart per plant in 2013 from a two-year old planting. Plants were two year-old plants in one-gallon containers. The plant height was about two feet while plant width was about two feet in 2013. “Draper” is a mid-season cultivar. The berries are medium sized and ripen slowly. The berries can take 2-3 weeks to ripen after they blue. “Draper” bushes are very compact and are very productive. It should also be noted that there was quite bit variation in our "Draper" planting. Regular water and proper soil amendments were critical to the establishment of "Draper."

Other new blueberry cultivars in our trial were “Aurora,” “Bluegold,” “Blue Haven,” “Bonus,” “Huron,” “Legacy,” “Liberty,” “Nelson,” “Patriot,” “Pink Lemonade,” “Sweetheart,” and “Toro.” “Aurora” seemed to be an excellent late-season cultivar. It appeared to be a productive cultivar, but the harvest season might be too late for many growers for Ohio. It might be better suited for frozen berry market. “Bonus,” though touted as a blueberry cultivar with very large berries, had not shown particularly large berries in our trial yet. 'Toro' did not seem to grow very well in our plot. “Legacy” and “Sweetheart,” two hybrids of southern and northern high bush cultivars, grew well, but were not particularly productive. Other new varieties had not shown

outstanding traits yet in our two-year trial. It is way too early for us to make any conclusion based on our limited experience with them.

“Pink Lemonade” is a new pink blueberry cultivar and has good berry size. The flavor is not very different than that of typical blueberries. It is hard to know if how well consumers will accept blueberry with pink fruits. We did not see much evidence to suggest that this pink-fruited cultivar will take the Ohio blueberry world by storm.

Dr. Gary Gao asked growers about their experience with new blueberry cultivars. Most growers seem to like "Draper." "Toro" was not well liked since the plants tend to grower more horizontally than upright. "Bonus" did not show great promise as the large fruit variety. Growers had only limited experience with other new varieties. Another complicating factor was that all blueberry cultivars are very site dependent. Even the same cultivar performs inconsistently on the same farm. Instead of rushing to try new varieties, Ohio blueberry growers should plant those that have been around for a long time first. They are "Bluecrop," "Blueray," "Chandler," "Elliot," and "Duke," and then add some "Draper." Plant other new cultivars for trial only.

5. Approximately 50 acres of new blueberry plantings were added since 2007. The total acreage of new blueberry planting did grow as a result of our outreach and research activities. It was much more difficult to get an accurate reading of the total blueberry acreage than we had anticipated. Blueberry farms are scattered all over Ohio. Most of them were not required to report anything to anyone. We didn't have the resources or the legal authority to collect acreage data. Hence, the acreage information collected was based on the PI's site visits, phone calls, email inquiries, growers' websites, and knowledge of extension educator.

Blueberry acreage information based on U.S. Ag. Census in 2007 and 2012.

Year	Total		Area harvested		Acre not harvested	
	# of Farms	Acres	# of Farms	Acres	# of Farms	Acres
2012	365	381	254	244	145	137
2007	263	382	183	193	108	189

It is hard to make sense out of the acreage data from the 2007 and 2012 Agriculture Census. We can easily see that there are more blueberry farms in 2012 than 2007. Approximately 51 more acres of blueberries were harvested in 2012 than 2007. Since the US agricultural census is only conducted every four years, it is hard to know what the state total acreage is in 2013.

There are many examples of new blueberry plantings throughout Ohio.

OSU South Centers, Piketon, Ohio

A new planting of 2.25 acres in Centerburg, Ohio.

A new planting in Mansfield, Ohio.

A small new planting in Danville, Ohio.

A new planting in the Auburn Township (Geauga County), Ohio.

A new planting in East Sparta, Ohio.

An addition to an existing planting in Wooster, Ohio.

It is safe to assume that at least 50 acres of blueberries have been planted since 2007. Most of the new plantings were around 2-6 acres while one planting was 20 acres. Dr. Gary Gao has visited many of these blueberry plantings. He also "found" more blueberry plantings after these new growers contacted him when they encountered problems. Otherwise, he would not have known whether these blueberry patches existed at all.

6. One of our goals was that "blueberry growers are expected to be well trained in production, propagation and marketing of blueberries. Growers will be able to get up-to-date information on key production and marketing issues. Blueberry growers can get higher yields and better prices for their products. The economic impact can be 1.5 million to 3.0 million dollars. A survey of blueberry prices will be conducted in year 1 and year 2. Post program surveys will be conduct in year to determine the economic impact."

We had a very comprehensive outreach program during the two years of the project. The project found out quickly that it was cost prohibitive to conduct a comprehensive survey of all blueberry growers to determine the economic impact. However, Gary Gao asked some of the blueberry growers about their yield data and potential impact. Since there was a late spring freeze during blueberry bloom in 2012, the statewide yields were down by 10 to 15%. Hence, yield increases were not achieved in 2012. Hence, out blueberry grower outreach was more about saving blueberry crop vs. increasing blueberry yields. We sent out email messages about using overhead irrigation to protect their crop. Unfortunately, only two blueberry growers in Ohio had overhead irrigation. They both used their irrigation system during the spring freeze. The good

news is that these two growers had a combined acreage of 35 acres. The estimated economic of our outreach efforts was about $420,000.

Since overhead irrigation is very expensive to install, most blueberry growers in Ohio only use drip irrigation. When we talked to both new and existing blueberry growers in Ohio now, we make sure that they are aware this risk. It is still a difficult financial decision for all of them though.

In 2013, the blueberry yields were quite high due to more favorable weather conditions. Average yields of blueberries were estimated to be around 5,000 - 7,000 thousand pounds per acre. Since a main source of fruit loss was bird damage, we showcased our bird netting at our field days. In 2013, the value of the Ohio's blueberry crop was worth at least $4.89 million dollars and could have been as much as $6.8 million dollars. The bird netting we used was called the "Smart Net" system. One new grower told us that he only harvested 200-300 pounds of blueberries before he had netting on his two acre patch. He was able to harvest 3,000 pounds after he had bird netting installed. If 300 blueberry growers followed our advice, the estimated impact could have been at least one to two million dollars!

Bird netting can be quite costly. It could cost $3,000 to $10,000 dollars to net one acre of blueberry planting. Growers in Ohio were still strongly encouraged to install bird netting. But, it still pays to have netting over the long run.

Most blueberry producers were made aware of our training programs, educational resources, and services. Most of them received training on the best cultivars to grow, how to efficiently fertilize and water their blueberry plants, how to effectively manage insects and diseases, how to prune blueberry plants, and efficient way to propagate blueberry plants.

<u>Grower Outreach in 2012 and 2013</u>

a. Presentations:

   In 2012, Dr. Gary Gao made several presentations at several educational workshops. Examples of these programs are Southwest Ohio Fruit and Vegetable School in Morrow, Ohio; Eastern Central Ohio Fruit and Vegetable Update in Newark, Ohio, Farm Science Review in London, Ohio, and End-of-the Season Blueberry Meeting in Vermillion, Ohio. The combined attendance was 140.

Dr. Gary Gao was the featured speaker at the 2013 Northern Ohio Blueberry School in Mansfield, Ohio. The program drew 20 attendees.

Northern Ohio Blueberry School in Mansfield, Ohio.

Dr. Gao was the featured speaker on blueberry production at the 2013 OPGMA Summer Tour on June 26 at Hirsch's Fruit Farm in Chillicothe. He gave his presentation seven times with approximately 250 attendees total.

OPGMA Summer Farm Tour at Hirsch's Fruit Farm in Chillicothe, Ohio

Dr. Gary Gao gave five research tours at OSU South Centers in Piketon from April 1 to June 30, 2013. These tours drew a combined attendance of 80. On July 18, Dr. Gary Gao showcased his blueberry plots at the Ohio Blackberry, Blueberry and Wine Grape Field night. The program drew approximately 100 attendees.

A wagon tour of our research plots at the OSU South Centers in Piketon, Ohio.

He was a panel member on the "Question the Authority" at the 2013 Farm Science Review. Dr. Gao gave a talk on blackberry production and also answered questions on blueberries. These sessions at the Farm Science Review drew approximately 60 attendees. Dr. Gary Gao gave a talk on blueberry production and marketing at the Midwest Fruit Workers Conference in October. The program drew 21 attendees.

b. Workshops at Piketon:
   In 2012, we offered two programs that were specifically designed for new and existing blueberry growers. These programs were Blueberry and Grape Pruning Workshop and Introduction to Blueberry Production Workshop. Several Horticultural Field Days were conducted where our new and existing blueberry plantings were featured. The combined attendance was 150.

   In 2013, two programs were offered that were specifically designed for new and existing blueberry growers. These programs were Ohio Berry School and Blackberry, Blueberry and Wine Grape Field Night. These two programs drew a combined attendance of 200.

Several horticultural field days, and research tours were conducted where our new and existing blueberry plantings were featured. The combined attendance was 250.

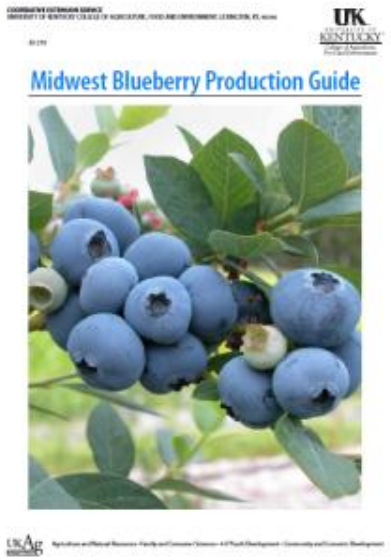
c. Grower Visits:
In 2012, Gary Gao visited many blueberry growers in Ohio. The blueberry farms in Ohio are scattered all over the state. It was quite time consuming to visit those growers. However, Gary was able to diagnose problems and provide recommendations to growers. The farms that he visited are Batts Blueberry Farm, Baumhart Berry Farm, Blue Jay Orchard, Blueberry Hill, Blueberry Valley, Cedar Lane Farms, Gerlach Blueberry and Fruit Farm, Hidden Creek Orchard, Hirsch's Fruit Orchard, Iron Orchard, Krieg Blueberry Farm, Lynd's Fruit Farm, Martin Blueberries, Messenger Century Farm, McCann's Blueberry Farm, Rouster's Apple House, Steve Kuflewski Blueberry Farm, The Blueberry Patch, Vogley Enterprises, and Z Blueberries.

Gary Gao visited approximately 30 growers during 2013. His visits covered pretty all corners of the state. The total acreage of the blueberry farms represented in his visits was about 100 acres. Some of the blueberry farms he visited were Baumhart Berry Farm, Berryfield Blueberry Farm, Berryhill Farm, Blue Jay Orchard, Blueberry Hill, Blueberry Valley, Ellsberry Buleberry Farm, Gerlach Blueberry and Fruit Farm, Hirsch's Fruit Orchard, Levo Farm, Martin Blueberries, Messenger Century Farm, Rouster's Apple House, Steve Kuflewski Blueberry Farm, The Blueberry Patch, Stacy Family Farms, Whitehouse Farms, and Willoughby Farm.

Ripening blueberries under netting at a blueberry farm in East Central Ohio are shown here.

7. Blueberry growers were well trained in production, propagation and marketing of blueberries Midwest Blueberry Production Guide, a new regional blueberry publication was written by researchers and extension professionals in Ohio and neighboring states. It is a comprehensive guide for all blueberry growers in the Midwest. Dr. Gary Gao wrote the chapter on soils,

fertilization and mineral nutrient disorders. He also contributed more than 50 pictures and helped with editing and design. About 2,500 copies of this bulletin were printed. Many of them were distributed to growers in Ohio and beyond. The regional production guide has served as a very helpful reference to new and existing growers.



Midwest Blueberry Production Guide received a blue ribbon extension publication award from the southern chapter of American Society of Horticultural Science in 2013, and was a national finalist in the bound book category of the communications contest hosted by the National Association of County Agricultural Agents in 2014.

Beneficiaries:

Both new and existing fruit growers were the beneficiaries of this project. Consumers also benefited from farm fresh blueberries throughout Ohio. The average price for you-pick blueberries was about $3.25 in 2013. Many blueberry farmers generated record sales in 2013. Numerous farm jobs have been created or retained. It was hard to know how many jobs were created or retained. But, Gary Gao had observed that many blueberry farms in Ohio had hired somewhere between 5 to 10 employees. One blueberry farm hired 45 people during the peak of you-pick season. It was estimated that at 300 to 500 jobs could have been retained.

The farm supply sector for blueberry growers also the potential beneficiary. The economic impact of fertilizer, herbicide, insecticides, irrigation supplies, bird netting, and packaging materials could have been $1.8 million dollars from the existing blueberry farms. Fifty acres of new blueberry planting could represent an investment of $2.4 million dollars. Since more growers are still planning on planting blueberry plants during a few years due to our outreach efforts, they number can easily double. The total potential economic impact could be as much 4.2 million dollars and can be as much as $10 million dollars, if 150 acres of new blueberry planted were planted during the next 5 years.

Lessons Learned:
Despite all of the process made during in 2012 and 2013, blueberry growers in Ohio are still facing many challenges. Adverse weather conditions, nuisance wildlife, high soil pH, and high costs of establishing blueberry plantings were major limiting factors in Ohio blueberry production. With our project, the scope of work that we had proposed was also too big for the funds allocated. It was far more difficult to locate all of the blueberry growers in Ohio than we had anticipated. Good economic data were very hard for us to gather. Ohio blueberry growers still need more help than ever in order to stay in the business.

Contact Person:
Dr. Gary Gao,
Extension Specialist and Associate Professor
Email: Gao.2@osu.edu
740-289-2071

Additional Information:
a. New Extension Bulletin:
Title: Midwest Blueberry Production Guide. 2013.
Web Address: http://www2.ca.uky.edu/agc/pubs/ID/ID210/ID210.pdf

"Midwest Small Fruit and Grape Spray Guide"
Drs. Gary Gao, Mike Ellis and Celeste Welty of The Ohio State University have been involved in the revision of this regional publication in 2012 and 2013. The spray guide is a key reference for commercial blueberry growers in Ohio and beyond.

b. Trade Magazine:
Title: "Blueberry Production in Ohio: Opportunities and Challenges"
Dr. Gary Gao wrote an article that is entitled "Blueberry Production in Ohio: Opportunities and Challenges" in "Today's Grower." "Today's Grower" is a quarterly publication of the Ohio Produce Growers and Marketers Association.

c. Extension Newsletters:
"Ohio Fruit News" - Several issues of the Ohio Fruit News were published in 2013. Ohio Fruit News was emailed to about 350 subscribers.

d. Website:
OSU South Centers Website - Our website was redesigned. We had a page for commercial blueberry production. Currently, the information is not complete. We will add more information to the page.

e. Press Releases or News Articles:
Title: "OSU researchers to boost production of blueberries" By DOUG GRAVES, Ohio Correspondent
Publication: Farm World
Date: July 13, 2012
Link: http://www.farmworldonline.com/News/NewsArticle.asp?newsid=14955
Title: "Bring on the Blue" by Jill Sell
Publication: Ohio Magazine
Date: August 2012 Issue
Link: http://www.ohiomagazine.com/Main/Articles/Bring_on_the_Blue_4628.aspx

---

Project Title: Building Supply Chains for Ohio Specialty Crops

Project Summary:
The Center for Innovative Food Technology partnered with Greenline Foods, Hirzel Canning, JM Smucker and Kroger Company on this project. The following information describes the results of the project coordinated by CIFT to review the requirements, capacity, and variables for consideration in order for growers to contract with food processors searching for local products. A comprehensive evaluation incorporated input from growers, information from food processors, and economic evaluations on the manner in which a shortened supply chain can impact the food system.

The Center for Innovative Food Technology (CIFT) is a not for profit organization whose mission is to provide technology based economic development support to Ohio's largest industry, food processing and agriculture. CIFT has interacted with Ohio's food processing sector since 1997, and has established an in-depth understanding of the industry and the issues that it faces. CIFT has also developed ongoing business relationships with several hundred of Ohio's processors. It is through many of these relationships that CIFT became aware of the relatively small quantities of local specialty crops that are used by Ohio's food processing establishments. The market demand was such that there appeared to be several tangible opportunities to connect specialty growers with processors, which in turn led to the strong belief that more opportunities for business relationships exist.

The goal of this project was to identify potential relationships and to define and document the requirements for product quantities, condition including grade, size, form, and other essential items. For those products that require some level of minimal processing, sources of that processing were evaluated. For items requiring more significant levels of processing, i.e. freezing or frozen storage, sources for that service were also identified. Cost models were prepared for each opportunity and information shared with growers.

This report describes the tools and mechanisms that were used to identify and catalogue opportunities and accomplishments toward achieving them. Any and all questionnaires, personal interviews with processors, and other communications were directed only on those items designated as Specialty Crops. Relationships established between Ohio growers and Ohio

processors increases revenue to growers and should help to mitigate financial risks. Processors benefit from lower acquisition costs and enhanced product quality considering a shortened supply chain.

Project Approach:

There are over 1,100 food processors in Ohio ranging from small scale local to ingredient suppliers to manufacturers, and nationally recognized operations. Couple this with the fact that Ohio has 13.9 million acres in farmland, with 82,335 specialty crop acres; the focus on supply chain development is evident. Ohio is home to 6,472 specialty crop farms averaging 13 acres per farm (2007 USDA Census of Agriculture). The challenge with engaging specialty crop growers in supplying to food processors is that many are focused on selling their product to fresh markets only. This is reflected in that 257 farms of less than 15 acres (close to the 13 acre average) are harvested for processing, while 2,375 of the same size farms sold for fresh markets. Further demonstrating this point is 47,014 acres of vegetables were harvested in 2007 (last census) with 29% going to processing and 61% to the fresh market. These numbers were anticipated due to the emphasis consumers have placed on local products and the support for farmers' market venues in recent years. There remains, however, an opportunity for diversification within a farm operation, expansion into new markets, and increased production through the purchasing agreements with processors. Numerous examples of such are prominent within the region through companies such as Campbell's Soup, Greenline Foods, Hirzel Farms, and Wyandot just to name a few that already have well established and long term arrangements with local growers to support their product needs.

The approach taken to achieve this initiative was broken into four main categories; identification of opportunities, evaluation of these opportunities, documentation, and dissemination to growers. Each of these is noted below in greater detail.

1. Identification of opportunities. Through a combination of personal calls with current CIFT customers, accumulation of opportunities about which CIFT staff is aware, and questionnaires circulated electronically and personally; the quantities, types, and condition (fresh vs. frozen, package size, diced vs. whole) of crops that are, or could be produced in Ohio were solicited. Through this information collection phase, details relating to who to grow it for, what to grow, how much, and expected delivery conditions were captured. It takes time for a grower to search for opportunities with food processors and therefore, not always viewed as the best avenue. Through this initiative, information was captured on growers that have the potential to manage such agreements and CIFT served as the conduit for communication. These interactions will continue following the conclusion of the project. Once an opportunity is identified, a grower will introduce the farm, its potential for growth, and ability to supply products that meet the processor needs. The farm must be prepared to demonstrate its business authenticity, along with necessary paperwork including regulatory licenses, audits, and food safety certifications. If a partnership is established, both parties should agree on pricing, quantities, timing of delivery, product variety, packing specifications, labor policies, and payment terms among other details. A critical component is management of any unforeseen event such as weather challenges and crop loss. If done successfully, working with a processor can lead to additional opportunities such as new crops and long term profitable relationships.

2. Evaluation of opportunities. As information about opportunities was collected, the process of evaluating the scale and feasibility began. CIFT began analyzing and documenting the size and potential revenue from each identified opportunity. A few examples are provided below further demonstrating this process.

a) A potato chip company was looking to create a new item, Sweet Potato Chips, and needed sweet potatoes. Through interactions associated with this program, a local farm was contacted that raised sweet potatoes and agreed to grow 5,000 pounds for product testing. These sweet potatoes were harvested and shipped in the fall of 2013. Test results were mixed as the potatoes were washed to specification, but the variety of sweet potato was not provided initially by the processor. It was discovered that the "Beauregard" variety was too large for the chipping line. The grower then modified operations in 2014 with a smaller "Cavendish" variety and provided to the processor for evaluation. This item is now the fastest growing product in the company's line of snacks and will continue to grow the quantity of potatoes purchased locally from this grower and potentially others.
b) Synergy Flavors, an ingredient company, was searching for a natural vegetable colorant for its beverage flavorings and preliminary tests showed purple carrots as promising. A farm in Henry County agreed to grow 500 pounds of the "Deep Purple" variety of carrots for a full processing run. Testing is ongoing and final analysis will not be available until late 2014, although very promising. The grower uncovered a few lessons including the variety was more difficult to grow, as it tended to bolt, and yield was not as high as common orange carrots. Another grower has been indentified for 2015 to compliment the product grown by this farm and when testing has been completed it will further expand this market opportunity.
c) Bon Appétit Management Company was looking for Ohio grown corn on the cob to serve at their college institutions during the school year. A local grower was able to provide the 50 bushels needed to carry them through the 2013-2014 school years. The corn was pre-processed to specification, shucking and de-silking before delivery to a freezing operation, where the corn was cut in half, flash frozen, and transported to an area storage facility. University students will enjoy Ohio sweet corn several times during the school year, as part of Bon Appetit's local oriented menu. Other specialty crop growers participated in previous years as well as with an assortment of crops ranging from strawberries to green beans and brussel sprouts. Each grower has the potential to expand current production and establish a pre-arranged price for the crop which is useful in full season planning.
d) Okun Produce wants to differentiate themselves from other local and regional wholesalers, while maintaining quality and food safety. A local Primus certified tomato & lettuce grower, is providing early season greenhouse tomatoes to Okun Produce, gaining additional volume and selling quality locally grown tomatoes to restaurants and retailers throughout the service region. They are also growing hydroponic lettuce, basil, and cilantro in the greenhouse which enables a harvest earlier than field growers and can extend the season into the fall months for those specialty crops as well.

These are a few examples of the relationships developed through this initiative. To compliment the information collection and provide for continued interactions, all details collected on growers

was captured in a catalog that will serve as a tool for identifying the crops and capacity for such interactions and will ease the identification when opportunities arise with a food processor.

3. Documentation of opportunities. Through various methods of information collecting including survey, direct interaction, participation in industry events, presentations to growers and on-site visits with both growers and processors; information was captured. The above mentioned catalog focuses on which growers have the potential to embark on a market such as supplying to processors and what types of crops they currently grow or could expand into. In addition, a document was created that more specifically serves as a guideline for growers depicting the areas for consideration prior to establishing an agreement. Some of these have already been mentioned but reinforced through this guide as being critical to the decision making process. Details such as varieties, method of delivery, certifications required, pricing, timing, receiving specifications, traceability paperwork, and more are specifically defined and will assist in determining if this market is appropriate for a grower. The document is attached for further reference and will continue to be modified based on new regulations and industry demands.

4. Dissemination of project results. CIFT designed an outreach program specifically to specialty crop growers and potential growers in order to increase awareness of the opportunities. This was achieved through association meetings, local grower outreach, direct consultations, written materials, and other electronic means. Examples of activities include staffing a booth at the Ohio Produce Growers & Marketers Association trade show to administer surveys three years in a row as well as providing information directly to growers about the requirements and benefits of partnering with processors. More than 276 growers were contacted in April 2012 via US Mail with a specialty crop survey. An additional 104 southwest Ohio growers were contacted in August 2012 via the same channel with a specialty crop survey. CIFT sponsored a Specialty Crop Listening Session with 15 growers in July 2012 and a follow up ARS Specialty Crop Forum with growers, food processors, USDA ARS researchers, and Dr. Kathleen Merrigan, Deputy Secretary of Agriculture, along with elected officials and media in August 2012 to further encourage attention and interaction between the growers and processors. CIFT held a Growing Opportunities meeting in December 2013, wherein growers were presented the opportunity to hear directly from three different processors on what the expectations would be of a partner and how to facilitate a working relationship. Individual meetings have been held with more than 80 Ohio producers, providing information on the benefits and requirements of partnering with food processors. Meetings have been held with Ohio processors, explaining the benefits of locally grown, shortened supply chain, and determining what processors are looking for when working with growers. CIFT will continue to meet with growers about expanding their local market to include Ohio processors, as well as food processors, explaining the benefits of diversifying their supply chain as well as using locally grown produce in their products.

Goals and Outcomes Achieved:

Given the large number of licensed food processing establishments in Ohio it is difficult to quantify the number of supplier-purchaser arrangements that currently exist. Therefore, the approach was to acquire documentation and verification from only the new purchasers of local produce engaged by this project. Attempts were made to define the economic impact of these new transactions. CIFT has measured success based upon (1.) value of crops provided by

specialty crop growers through arrangements facilitated and (2.) estimate cost savings realized by the processing companies on the "other side" of these arrangements.

A few examples are provided below further demonstrating this process.

a) A potato chip company was looking to create a new item, Sweet Potato Chips, and needed sweet potatoes. Through interactions associated with this program, a local farm was contacted that raised sweet potatoes and agreed to grow 5,000 pounds for product testing. These sweet potatoes were harvested and shipped in the fall of 2013. Test results were mixed as the potatoes were washed to specification, but the variety of sweet potato was not provided initially by the processor. It was discovered that the "Beauregard" variety was too large for the chipping line. The grower then modified operations in 2014 with a smaller "Cavendish" variety and provided to the processor for evaluation. This item is now the fastest growing product in the company's line of snacks and will continue to grow the quantity of potatoes purchased locally from this grower and potentially others.

b) Synergy Flavors, an ingredient company, was searching for a natural vegetable colorant for its beverage flavorings and preliminary tests showed purple carrots as promising. A farm in Henry County agreed to grow 500 pounds of the "Deep Purple" variety of carrots for a full processing run. Testing is ongoing and final analysis will not be available until late 2014, although very promising. The grower uncovered a few lessons including the variety was more difficult to grow, as it tended to bolt, and yield was not as high as common orange carrots. Another grower has been indentified for 2015 to compliment the product grown by this farm and when testing has been completed it will further expand this market opportunity.

c) Bon Appétit Management Company was looking for Ohio grown corn on the cob to serve at their college institutions during the school year. A local grower was able to provide the 50 bushels needed to carry them through the 2013-2014 school years. The corn was pre-processed to specification, shucking and de-silking before delivery to a freezing operation, where the corn was cut in half, flash frozen, and transported to an area storage facility. University students will enjoy Ohio sweet corn several times during the school year, as part of Bon Appetit's local oriented menu. Other specialty crop growers participated in previous years as well as with an assortment of crops ranging from strawberries to green beans and brussel sprouts. Each grower has the potential to expand current production and establish a pre-arranged price for the crop which is useful in full season planning.

d) Okun Produce wants to differentiate themselves from other local and regional wholesalers, while maintaining quality and food safety. A local Primus certified tomato

& lettuce grower, is providing early season greenhouse tomatoes to Okun Produce, gaining additional volume and selling quality locally grown tomatoes to restaurants and retailers throughout the service region. They are also growing hydroponic lettuce, basil, and cilantro in the greenhouse which enables a harvest earlier than field growers and can extend the season into the fall months for those specialty crops as well.

Continuing with the successes noted above, additional details are provided related to the economic impact associated with each agreement and serves as a guide for future collaborations.

Sweet potato for potato chips:

1. The value associated with 5,000 pounds for the test run $1,625 (USDA Detroit Market October average).
2. Yearly potential of $32,500 (1/2 truckload, 5,000 pounds per 20 weeks) delivered product. New item value to the processor is estimated at $350,000 ($1 margin per bag) per year.
3. Estimated cost savings realized by the processing companies on the "other side" of these arrangements is reflected in cost of truck and driver from North Carolina would be $760, ($200 driver, $160 truck depreciation, $400 diesel), cost of truck from Henry County would be $315 ($200 driver, $80 truck depreciation, $35 diesel), savings of $445 in transportation costs. Intangible costs would be freshness of potatoes, less risk of damage during transit, and maintained yield due to decreased travel time.
4. Metrics regarding increased acreage in specialty crop production:
   An additional 1 acre was planted in sweet potatoes (yield of 125 /cwt per non irrigated acre, Oregon St. University). Number of growers diversifying crops based on competitive advantage associated with contractual agreements with processors or distributors is currently a single grower with more anticipated. A comparison between percentages of ingredients purchased locally before and after relationships was facilitated. The sweet potato chips are a new item and have no previous sales history. Ratio is expected to be 35% Ohio grown in season plus storage and 65% out of state grown.

Purple carrots:

1. Value of crop: the 500 lbs purple carrot test harvest 2013 was valued at $12.50 fob per 50 pound sack, with a .15 per pound charge for the extra costs associated with purple carrots, total projected value of $200.00.
2. Estimated cost savings realized by the processing companies on the "other side" of these arrangements. Cost of truck and driver from California would be $2060 ($400 team drivers, $160 truck depreciation, and $1500 fuel); cost from local grower would be $380 ($200 driver, $80 depreciation, $100 fuel).
3. Metrics regarding increased acreage in specialty crop production. An additional 1/4 acre was planted in purple carrots (yield of 20,000 pounds per non irrigated acre).
4. Number of growers diversifying crops based on competitive advantage: a single grower in 2013, with plans for an additional Ohio grower to provide crop diversity in 2014 and beyond.
5. Comparison between percentages of ingredient purchased locally before and after relationships was facilitated. Purple carrots are a new item, and have no known

quantifiable growing history. Purple carrots for this processor are expected to be 100% Ohio grown.

Local tomatoes:

1. Value of Crop: the greenhouse tomatoes valued at $25 per 20 pound box, estimated production from May 1 to July 1 to be 1,000 boxes, for a $25,000 gross.
2. Estimated cost savings realized by the processing company: Cost savings may not take place in this opportunity, but increased sales should be a metric to quantify. The increased costs of producing in a greenhouse environment with supplemental lighting and heat can negate any savings in fuel and transportation costs. Restaurants, caterers, and hotel operations will build menu options to market the locally grown aspect of the tomatoes and other crops earlier in the season. This will drive consumption of the special menu items, increasing sales not just for the tomatoes, but for all other ingredients and associated items (drinks, desserts). Employment opportunities may be created at the restaurant/caterers/ hotel operations, as well as the wholesaler and grower.
3. Metrics regarding increased acreage: the grower has a 5,000 square foot greenhouse with the majority of that now in tomatoes, estimated yield of 20,000 pounds, at $1.25 per pound.
4. Number of growers diversifying crops based on competitive advantage: While there are several local early season greenhouse tomato growers, this one has the Primus audit that satisfies buyer's commitment to food safety. Additional will likely take the necessary steps to achieve this status.
5. Comparison between percentages of ingredient purchased locally before and after relationships was facilitated: It will be difficult to quantify, as this is not a new item but an item with increased availability, extending the season that locally grown tomatoes will be marketable.

Sweet corn:

1. Value of Crop: the sweet corn valued at $28 per bushel, shucked, de-silked and delivered to processor for freezing was $1400.
2. Estimated cost savings realized by the processing companies on the "other side" of these arrangements. The company needs Ohio grown sweet corn for its menus, and while not a quantifiable cost savings, it meets its marketing requirements. In addition, the cost of truck and driver from Florida would add $1652 ($600 driver, $240 truck depreciation, $812 fuel).
3. Metrics regarding increased acreage: An additional 1/5 acre was planted in sweet corn (yield of 240 bushels per non irrigated acre).
4. Number of growers diversifying crops: this farm provided sweet corn in 2013, and the company is looking to contract with additional growers in 2014.
5. Comparison between percentages of ingredient purchased locally before and after relationships was facilitated: Ohio sweet corn is and will be specified for these menus and customers at 100%.

NOTE: Trucking Data: $100,000 used semi-truck, straight line depreciation over 5 years, $80 per day. Diesel at $4.00 gallon, truck fuel mileage estimated at 6.5 mpg, drivers paid $200 per

day. There are other wear costs for the truck that are not accounted as well as miscellaneous additional travel expenses.

Evaluations such as these and successful economic impacts will be highlighted in future discussions with growers and processors alike. Each of the above mentioned interactions has potential for expansion and inclusion of more growers should they deem it applicable to their operation.

Beneficiaries:
Specialty crop agriculture in Ohio is increasing, with growers selling the produce directly to consumers via farm stand and increased farmer's market presence. Small farms are able to sell to consumers and local retail markets at higher margins, due to the consumer's value perception of locally grown and know your grower marketing. Processors are considered as a market and increased profit & production is attractive, but growers face several hurdles. Working with processors can increase input costs to comply with variety acquisition, quality, pricing and supply contracts, regulatory and audit requirements, and payment terms, as well as land and labor acquisition.

Growers may be perceived as "aiming low", but they are able to keep costs down, obtain adequate labor, and maintain higher margins by direct marketing through farmer's markets, CSA's, on-farm markets, as well as locally owned supermarkets, institutions, and restaurants.

Processors would prefer to purchase local ingredients. Theoretically, it would shorten transportation time and cost, as well as recovery time from supply chain/processing errors and have a positive impact on regional marketing, but the present model of growing in western states and Latin American countries is more efficient and economical for procurement teams to purchase quantities needed from brokers and consolidators.

The year round availability of fresh produce has created an entitlement effect with consumers. Ohio specialty crops can be harvested in and out of season, with the use of hydroponic greenhouses, artificial lighting, low and high tunnels, and other season extension methods. Ohio has an advantage with the availability of water, versus the concerns of the western states diminishing water supply.

Ohio specialty crop growers can supply produce for the food processing industry. The food processing industry will need to partner with the growers to overcome regulatory and auditing challenges, but it will benefit the processors by shortening supply chains, reducing time from field and providing regional marketability. Growers will need to work with the processors, meeting the requirements for varieties, harvest timing, and providing necessary food safety audits and initiatives. Ohio growers can look forward to partnerships with food processors, both sustaining the economy and supporting job creation.

Ohio groups that benefit include:

- every grower considering increasing their business opportunities

- non-specialty crop growers (commodity crop growers, floriculture greenhouse operations) that are considering specialty crops. This group benefits by learning the options that growers have to market the produce, as well as learning what customers will need to purchase the produce, i.e., best variety, size, harvest timing, insurance, market and contracted prices, food safety, etc.

- growers considering expansion beyond on farm markets, farmer's market locations, and community supported agriculture. This group benefit by learning what customers need to purchase product at this level, i.e., varieties, sizes, harvest timing, insurance, food safety, pricing, etc.

- growers investigating marketing to wholesale distributors supplying retail stores. This group will learn what the wholesaler's customers require regarding product quality, preferred varieties, timing, etc.

- growers investigating marketing to wholesale distributors supplying food service – restaurants. This group benefits by learning what the chef's needs for quality, freshness, and should the product be minimally processed. The restaurant manager usually has different needs, such as food safety, liability, and consistency of product.

- growers investigating marketing directly to retail stores. These growers benefit by understanding that retailers not only need a quality product, they require food safety and insurance commitments. The price negotiated with these types of customers can be a little higher than the wholesaler, but still leave room for the retailer to make his profit.

- growers investigating marketing directly to chef's and restaurants. These growers benefit by understanding the needs of chef's and restaurant manager, the chef needing quality product delivered in time for preparation, and restaurant managers needing appropriate pricing, invoicing, insurance, and food safety audits.

- retail stores, chef's and restaurants looking to market locally grown produce to consumers. The retail store benefits from this report by understanding the challenges that local growers face, and helping them navigate through food safety, insurance, delivery procedures, quantity and pricing commitments, so that both can be successful. By partnering with the local grower, the retailer/ restaurant can market the local produce, increasing customer count and sales.

- wholesale distributors for both retail and food service that are looking for locally grown produce

- food processors looking to incorporate locally grown produce into their product lines

Potential beneficiaries include:

There are 3,923 Ohio specialty crop growers (USDA 2012 Census of Agriculture, vegetables, fruits, & berries combined), and a conservative estimate of 5% or 196 growers work with food processors, could lead to an additional $2,815,550 in farm revenue (average farm revenue of $41,043, with a 35% increase, or $14,365).

There are over 1,100 Ohio food processors and a conservative estimate of 5% or 55 processors work with those 122 growers.

Potential economic impact of project could include:

Increased dollars for growers; $2.815 million

Increased jobs with growers; 196 growers adding one seasonal employee each, $1.13 million back into the Ohio economy

Increased sales for food processors marketing locally grown ingredients (example of a tomato processor with $1 million in sales, marketing locally sourced tomatoes, increases sales by 15%, or $150,000, less 5% additional marketing costs, increases his bottom line by $100,000).

Increased sales for restaurants serving locally sourced menu items

Increased sales for retail grocers selling locally produced food items

Lessons Learned:
As with evaluating any new market or business opportunity, there is much to be learned and taken into consideration on both sides. A few of these lessons are noted below to further demonstrate the complexity of local to processors.

1. Growers are hesitant to invest in new equipment or labor intensive pursuits that are associated with new crops or increased production. Interest rates are historically low, which aids the purchase of new equipment, but land is historically high per acre and labor costs have increased, if labor is even available.
2. Growers are the size they want to be. For a grower to supply a processor, they will need to plant an increased amount of acreage for the crop the processor needs, which requires additional land and labor. The small growers are not inclined to increase in size, and the larger grower's contract quantities pre-season and either have the land or can rent, if economical.
3. Food processors have specialized needs and require certain products to be processed more than a grower's capabilities. An analogy is the automotive industry and assembly line manufacturing. A frozen pizza company assembles parts sourced from specific suppliers and can require proprietary recipes for each "part". Frozen pizza needs tomato

sauce, not fresh tomatoes. They may be particular about a variety of tomato, and use a proprietary recipe for the sauce that differentiates them from other pizzas, and that would need to come from a tomato processor. Grower to tomato processor, tomato processor to pizza company, to retailer, to consumer. The supply chain can have multiple stops, depending on the ingredients of the finished product.

4. Growers have the customers they want. Some growers already work with processors and are the size to supply the needed quantities at needed times. Others do not have the resources to work with larger businesses and the associated requirements, including audits and regulations.
5. Growers and food processors work under time and temperature constraints. Specialty crops need to be harvested to maintain the best visual and flavor profile, in restaurant/retail market and processing facility environment. This addition of grading and cooling equipment, and the associated labor inputs of packing, sorting, maintenance, laboratory, logistics and trucking, marketing, sales, and accounting, are capital expenses that growers will need to factor in to the pricing.
6. Growers will still have to compete with western and southern states that have longer growing seasons, as well as Mexico and other Latin American countries that have lower input costs and longer growing seasons. Total market pricing is creating downward pressure on Ohio grown pricing, unless growers can define Ohio produced crops as superior and worthy of higher prices, both at processor and consumer levels.
7. Growers that grow for processors will negotiate pricing contracts and will not get the high margins that are seen with direct to consumer pricing. Growers must understand that increased sales make up for decreased margins, providing that input costs are all appropriately accounted.
8. Growers of specialty crops will face increased regulation over the next few years. The Food Safety Modernization Act will affect all growers, regardless of acreage, revenue, and customer base. Growers who maintain the direct to consumer model will be required to maintain more records and adjust growing practices, which will increase costs and time involved. Growers who build partnerships with processors will be faced with the same recordkeeping and practice adjustments, and will also be required by the processor to provide additional information and pass key audits that the processor's customers may require. Processors are working with growers to help achieve these goals, because they realize that they need to develop qualified growers as well as diversify their supplier base.
9. Growers can find connecting with food processors a strain on time resources. Directly contacting the company can work, but finding the correct employee can be the challenge. Processors generally have separate procurement teams for raw materials versus packaging, equipment, and maintenance supplies. Food processors should have a dedicated department to work with growers, both in the office and to visit fields. Another way growers can connect processors is to attend regional and national trade shows, but again may not meet the employees dedicated to procuring raw materials. Networking with other growers at the trade shows can provide insight into the processor's organizational structure, but those other growers may also be concerned of competition.

Although the challenges appear numerous, the potential is exemplary in continuing to build a grower's bottom line while enhancing the marketability of some processed foods. Embracing this

venue is a tough decision for growers but can be a consistent and valuable source of revenue should it be pursued.

Contact Person:
Rebecca Singer
Vice President of Director of Agricultural Programs
rsinger@ciftinnovation.org
419-535-6000

Alan Bernard
Project Manager
abernard@ciftinnovation.org
419-535-6000

Additional Information:
The insights gained and the documentation created will continue to be updated and shared with growers and processors beyond the completion of this project. Supplemental documents mentioned within this report are attached including the survey and guidelines for growers. Supporting the vibrant food processing industry in Ohio with locally grown specialty crops will enable the food processing and agricultural industry to thrive.

Project Title: Integrating microclover with turfgrass to produce a more environmentally sustainable turfgrass ecosystem.

Project Summary:
Sod producers in Ohio spend over $7.3 million annually to maintain over 6,000 acres of turfgrass, with 100% applying weed control, fertilizer, and supplemental irrigation. A reduction in the number of fertilizer and weed control applications and irrigation made annually is necessary to produce an acceptable sod using standard monoculture production practices for several reasons. This industry provides an economic value to the state, employing over 41,000 full-time employees and 4.6 billion dollars in total economic impact. Therefore, producing a more sustainable turfgrass ecosystem requiring less cultural inputs and environmental resources, provides a positive impact financially, environmentally and competitively to sod growers and the turfgrass industry in the state of Ohio.

Turfgrass is considered one of the top non-sustainable green systems on the market by environmental groups. Turfgrass is expensive to maintain with weekly mowing, regular fertilization, pesticide inputs and supplemental watering. The purpose of the project was to determine if inclusion of microclover within a turfgrass system could result in a more sustainable system. Based on our agronomic data and on the costs of producing sod as determined during the development of our enterprise budgets and sod farmer surveys, we believe that producing microclover/turfgrass blends may result in up to 50% cost reductions for fertilizer, 20% reductions in pesticide and 2.5% for fuel and labor costs, though the actual numbers would vary

based on growing year and location. Enterprise budgets were developed to assist sod farmers who wish to produce microclover/turfgrass blends. The Ohio State University managed this project.

Project Approach:
In order to determine microclover's ability to reduce fertilizer, water and pesticide inputs, three field trials were established in autumn 2011 at: OSU Turfgrass Research and Education Center (established on September 14, 2011), Green Velvet Sod Farm (established on October 6, 2011) and Medina Sod Farm (established on October 11, 2011). Our study establishment failed at Medina Sod Farm and was replaced by a study that was established at Columbus Turf Nursery in Autumn 2012.

During Autumn 2012 at the OSU, Green Velvet, and Columbus Turf Nursery locations, we collected data on: drought resistance, nitrogen levels, clipping yields, soil moisture, weed cover, turf establishment, turfgrass percent cover, weed percent cover and percent cover of microclover. Soil samples were collected and routine plot maintenance at both sites was conducted during this time. At the OSU location, clippings were collected for analysis by CLC Laboratories. Drought study data were presented as a poster at the American Society of Agronomy meetings in Cincinnati, Ohio in October, 2012.

In April 2013, data were collected at the OSU and Green Velvet study sites in order to determine percent clover and spring green-up of the turfgrass. Then, from April until September 2013, the research sites at OSU and Green Velvet were maintained by mowing regularly and watering to prevent drought during non-dry-down periods. Data were collected monthly at both sites in order to determine – percent cover of turfgrass, visual quality of turfgrass, percent weed cover, and percent microclover cover. Clippings were collected, dried and weighed, and sent to CLC laboratories for tissue analysis. Soil samples were also collected and sent to CLC labs for analysis. In August 2013, a short dry-down period was initiated and lasted for approx. 10 days and stress and recovery data were taken. Study data were presented as a poster at the American Society of Agronomy meetings in Tampa, Florida in November, 2013.

Green Velvet Sod Farms, Medina Sod Farm, Columbus Turf Nursery, and the Ohio Turfgrass Foundation were project partners who donated land usage and maintenance support for the field study portion of the project. In addition, DLF International donated the microclover seed that was utilized for this project.

Progress and results of the microclover project at the OTF center were included in the OTF field day booklet in 2012. Progress and results were formally presented to 150 attendees and an additional 150 attendees could view the research plots because they were signed. The study was also signed and viewable by attendees in 2013 and 2014 (approximately 220 attendees in 2013 and 300 attendees in 2014). Results were presented at the Ohio State University Nursery Short Course, which is held in conjunction with the Central Environmental Nursery and Trade Show

(CENTS) in Columbus, Ohio in January, 2012 (50 attendees). A poster highlighting results of the project was displayed at the OTF conference and show in December, 2012 in Columbus, Ohio (viewable by up to 2200 attendees). Results were presented at the December, 2014 OTF conference and show in Sandusky, Ohio (20 attendees). Results of this project will also be presented in January 2015 at the Maryland Turfgrass Conference. I intend to continue to present results of this project at regional conferences.

In 2014, an economic analysis was conducted and sod producers were interviewed by the Ohio Bioproducts Innovation Center (OBIC) to gather both production and maintenance costs of lawn type sods in Ohio. Enterprise budgets were developed in collaboration with Ohio sod farmers and then the budgets were verified by surveys and on site interviews with Ohio sod farmers. The enterprise budgets can be used as a tool to show sod farmers potential cost savings were they to implement a microclover/turfgrass sod production system on their farms.

Goals and Outcomes Achieved:
The goals and outcomes of this project were both short and long term in nature.

Determine microclover's ability to reduce fertilizer, water and pesticide inputs.
Our results show that the inclusion of microclover with both Kentucky bluegrass and tall fescue resulted in better overall color quality than either species alone. This reflects a possible fertility benefit with the inclusion of microclover in turfgrass mixtures. We found that microclover was more predominant in the Kentucky bluegrass/microclover mixtures due mainly to slower establishment and less competition than the tall fescue/microclover mixtures. Overall, tall fescue combinations consistently resulted in better color quality than comparative Kentucky bluegrass treatments reflecting that Kentucky bluegrass is a more sustainable turfgrass species. The higher nitrogen content of the Kentucky bluegrass/microclover mixtures reflects a positive fertility contributor. Overall, tall fescue drought tolerance was superior to Kentucky bluegrass. However, the Kentucky bluegrass/microclover mixtures showed enhanced drought tolerance among Kentucky bluegrass treatments during the dry-down regime. All tall fescue treatments resulted in lower weed numbers compared to Kentucky bluegrass alone and Kentucky bluegrass + fertilizer treatments. This further substantiates the low input, sustainability characteristics of tall fescue. Kentucky bluegrass/microclover mixtures, however, resulted in significantly less weeds compared to other Kentucky bluegrass treatments, suggesting a microclover fertilizer contribution and/or allelopathy.

Inclusion of microclover improved visual quality and drought tolerance of Kentucky bluegrass and reduced encroachment of weeds such as dandelion and crabgrass.

Predictively determine the economic gains experienced from implementing microclover on sod farms.

Members of the Ohio Bioproducts Innovation Center met with sod producers to gather data that was utilized to create Enterprise Budgets for the production and maintenance of Kentucky bluegrass and Tall fescue sods. These enterprise budgets help to quantify the inputs necessary for the establishment and maintenance of traditional (monoculture) lawns. Theses budgets were then validated using surveys to Ohio sod producers. By establishing these budgets we hope to assist sod producers with examining the potential to reduce input and water usage requirements and to market and sell microclover containing sods as a specialty lawn alternative to receptive market segments. Based on our agronomic data and on the costs of producing sod as determined during the development of our enterprise budgets, we believe that our original projection of up to 50% costs reductions for fertilizer, 20% reductions in pesticide and 2.5% for fuel and labor costs are reasonable, though the actual numbers would vary based on growing year and location.

Implement the new management practices across five Ohio Sod Farms.

We have developed materials that will assist sod farmers in determining the economic benefit of implementing a microclover production system on their farms. However, based on the results of our field research and the economic survey the economic gains that we anticipated for the sod farmer did not materialize. In other words, the total potential savings in fertilizer, pesticides, fuel and labor might only reduce the cost of producing the sod by about 5%. The sod farmers also voiced concerns about marketing the product, selective broadleaf weed control post-transplant and potential changes to the ecology of the microclover/turfgrass as a result of transplant. Despite these concerns, our goal is to continue to work with the Ohio sod farm industry to promote the benefits of microclover and to encourage the farms to experiment with the concept of marketing and selling microclover/turfgrass blends.

Beneficiaries:
More sustainable sod mixtures containing microclover may reduce the long term maintenance costs for producers (when necessary) and for residential, commercial and industrial market segments. Results of this study quantify that there are appreciable benefits both economically and environmentally to more wide spread utilization of microclover as a specialty crop. The actual economic benefits for homeowners should be significantly higher since they tend to purchase fertilizers and lawn chemicals at retail rather than wholesale prices. Further studies of specific applications of microclover in commercial, residential and industrial simulations are needed to more specifically identify the benefits of long term usage. Very few mixtures of legume(s) and grass(es) currently exist for lawn applications, this may be a significant marketing opportunity for creating "branding" around a specific microclover and grass blend, especially if in the future there are restrictions on fertilizer amounts allowed for turfgrass.

The quantification of the beneficiaries affected by the implementation of this project depends on the eventual level of implementation by sod farmers and the amount of buy-in from the consumer. According to our survey, there is about $1875 in direct expenses to produce 1 acre of sod. If, as a result of including microclover, we reduce fertilizer costs by 50%, herbicides by 20%, and labor and fuel by 2.5%, then the total costs savings to the sod farmer is about $93 per acre. There are about 6000 acres of sod produced yearly in Ohio. If, for example, 10% of these acres were converted to turfgrass/microclover blends then Ohio sod farmers would see a savings of about ($93/acre x 6000 acres =) $55,800 per year. The actual acreage that may one day be converted to microclover/turfgrass blends will depend on numerous factors. For example, there is a lot more interest in microclover in the eastern U.S. due to concerns about the effects of turfgrass management on the Chesapeake Bay watershed. In some of these states there are restrictions on allowable fertilizer and pesticide applications to turfgrass. If similar restrictions on pesticide and fertilizer use were to be enacted in Ohio, interest in microclover/turfgrass blends might increase significantly. Another potential benefit that is difficult to calculate is that for the consumer. Presumably, a microclover lawn would require fewer pesticides, nutrients and water, which could result in significant cost savings to the homeowner.

Lessons Learned:
We had some difficulties establishing microclover at the sod farms. Specifically, Kentucky bluegrass did not establish well at the Columbus Turf Nursery. In addition, tall fescue at the Columbus Turf Nursery was partially fertilized accidentally by a maintenance crew who were fertilizing surrounding areas. At the May 2012 visitation, it was decided that due to very poor establishment of Kentucky bluegrass and the tall fescue being compromised by heavy accidental fertilization by the sod farm crew, the Columbus Turf Nursery research site was discontinued. A more concentrated effort was maintained at Green Velvet Sod Farm, where we also had difficulty establishing in 2011. There were no additional problems or delays at Green Velvet Sod Farms. The motor that was installed at the OTF Research Facility on the garage doors for the rain shelter was damaged by weather and was not functional. Dry-down period was performed during natural drought during rain-free periods in August of 2012 and 2013. By spring 2014, because of the nature of our small plots and experimental layout, the microclover had spread from intentionally planted plots into adjacent plots that were to be microclover free, which rendered the plots not usable for subsequent data collection. We did, however, get

multiple years data at the Ohio Turfgrass Foundation and Green Velvet Sod Farms, which we will publish in the scientific literature.

Because of the delays we experienced in generating positive data about the benefits of microclover, we encountered delays with our goal of implementing microclover productions systems on Ohio Sod farms, including our goal of increasing employment on Ohio sod farms. However, we will continue to work with Ohio sod farmers and we believe that given the environmental concerns associated with traditional turfgrass and the potential benefits of microclover/turfgrass that this will be a viable product that can be marketed by Ohio sod farmers.

Contact:
David Gardner
614-292-9002
gardner.254@osu.edu

Additional Information:
An article reporting the agronomic results of this project will be submitted for publication either to the Journal Horttechnology or Applied Turfgrass Science.

Abstract for poster presentation at 2013 American Society of Agronomy Annual Meeting:
https://scisoc.confex.com/scisoc/2013am/webprogram/Paper80175.html

Abstract for poster presentation at 2012 American Society of Agronomy Annual Meeting:
https://scisoc.confex.com/crops/2012am/webprogram/Paper75218.html

The enterprise budgets for the production of Kentucky bluegrass/microclover and tall fescue/microclover will be posted to the following website:
http://aede.osu.edu/research/osu-farm-management/enterprise-budgets

---

2011 SCBG Final Reports

Project Title: Wine Education and Awareness for Ohio Consumers and Grape Growing Awareness for school children

Project Summary:

With the Ohio grape and wine community an ever more important part of the agricultural community in Ohio, [190+ family owned wineries, an estimated 5000 full time equivalent jobs with an economic impact estimated at over $700 million]… but with less than 5% share of the total wine market in the state, this grant provided an opportunity to create vehicles that increased the presence, viability and thus the profitability of these small agricultural businesses which are

largely located in rural areas – and whose owners have limited marketing tools within their business structure.

This was especially timely as it built pride among elementary students in the agricultural communities in which they lived, primarily during the harvest season which is the most iconic time of year for growers. As more and more wineries emerge across the state, it is ever more critical that the industry develop creative and attention getting vehicles to drive visitation and sales in a market where only a tiny percentage of all wines sold in the state are manufactured within the state. Given the prior reputation of 'Ohio Wines are always sweet wines' the importance of driving visitation to and an understanding of the new generation of our wines is especially important among the Boomer group many of whom have the prior perception. For the skeptical Millennial and X generation groups, it is essential to present information to them in a form with which they are most comfortable.

Project Approach:

The project was aimed at 3 distinct demographic groups:

- Marketing the story of grapes to youth [emerging consumer group], especially in areas where grape growing is concentrated as a source of jobs, local pride and tourism development using an award winning book which teachers read, followed by a coloring book with educational information about how and why grapes grow and a rewards [Meier's grape juice samples, school themed gifts and a Grape-heart bear for each participating classroom.] A pre and post assessment of what was learned was included in the project.
- Marketing to the Boomer community in an interesting, yet educational way to encourage both knowledge of [via a board game with a series of 400+ Ohio specific questions relating to winemaking, grape growing, wine appreciation and winery-specific questions] and visitation [via a Passport card which encourage state-wide visitation and the winning of the game as a prize]
- A YouTube /QR code project for Millennial and Gen Xers [fringe consumer group] which consisted of a series of recorded interviews about wineries and the events they offer, wines they grow and family stories which would be of interest. These were posted on the association web site and were used in the printing of 100,000+ brochures. This portion of the project was actively promoted via tradition Social Networking channels.

Grape Juice Project: emerging consumer group

This project was largely completed and billed in December of 2012. We added/returned to the 12 classrooms noted in the attachment in the spring of 2013 and the fall of 2013. For these classrooms, we used the remaining Grapes Grow Sweet books and Meier's juice left over from the previous series. We printed additional coloring books and evaluation forms used cups and napkins from existing inventory to complete the project.

QR project report -- Fringe Consumer Group

As a result of consumer feedback, we expanded the video program from 60 second to 2 to 3 minute videos. Videos were posted on the YouTube channel of the Ohio Wine Producers Association. Each of the video QR codes which relates to the YouTube postings were created and used in various social media postings to promote traffic to the YouTube sites. Samples of those are included in the report packet. Those postings resulted in over 5000 individuals. Ninety four additional QR codes were created to drive additional traffic to YouTube postings of wineries in each of the 6 trail brochures which are included in the mailing. Over 100,000 total brochures using the QR codes have been printed and distributed.

Trivia game progress report -- Foundation Consumer Group

Two hundred game boards are printed along with two hundred boxes, 200 dies and 1200 'wine charms' along with 200 game 'rules' were assembled. Over 2400 questions were collected, assessed, organized and honed down to about 470 total in four categories: Winemaking/enology, Grape growing/viticulture, Wine appreciation and Entertaining with wine [including wine and food pairings] as well as 'Ohio Wineries and their stories.' 5000 'Passports' were printed and distributed in the games, by wineries throughout the state as well as by commercial distribution services, CVB's, selected wine gift shops and others around the state. A campaign promoting the project was launched via Facebook, Twitter and a consumer e list.

Goals & Outcomes Achieved:

The strength of this grant, for the Ohio grape and wine community is that it allowed the initial creation of programs not otherwise possible with the resources available. The opportunities provided by this project have established models which will be continued for several years going forward.

- Grape Juice project: The grant provided the resources to develop a pilot program which will continue, with private funding for at least the next several years. The industry now has established a relationship with dozens of elementary teachers and principals and it is the intent of the OWPA to continue to offer a Grapes Grow Sweet fall reading program not only to existing schools, but to expand it to others as requests come in to the office. Teachers will have a well-constructed lesson plan which reflects the local community; students will learn about the importance of grapes and wines to their region. We were able to present the Grape Juice program to a total of 84 classrooms with an average of 26 students per room for approximately 1650 students. The five questions were taken from the text of the Grapes Grow Sweet book and then reviewed by growers as to their importance to the growing of grapes and what happens in a vineyard. All but 3 classroom teachers returned their pre and post test results. The questions were geared toward second graders and more than 80% of the questions were correctly answered by the students.

- QR program: This project too will continue to expand, with private funding into the foreseeable future as more videos, more virtual social media campaigns and programs will be developed using the web site, YouTube postings and QR technology. Wineries who do not have the wherewithal to develop these kinds of

promotions will see additional exposure, traffic to their tasting rooms, consumer understanding of their products and services and will thus sell more wine. This library of videos will be ready and available for use when media requests come in – and as the industry launches various other promotions: example: during Ohio Wine Month in June, we will send out video teasers to regional media channels to either use or to encourage them to visit their local vineyards for a story. It will provide a trove of content for ongoing social media posts. We used the QR codes in the regional wine brochures and created them for 89 wineries across the state. Some of these fed to their wineries' own websites, some to their YouTube videos and 30 winery specific plus 6 wine festival and trail videos on the association web site. The total views on YouTube with associated QR codes total 4411 in 2012-13 vs 605 from the 2009-2010 varietal series posted on the web site prior to the receipt of the grant.

Trivia game: With the creation of the basic game board and game rules, on a regular basis the questions will be revised and updated to reflect the changing nature of the industry. Future reprints of the game will be offered for sale in wine shops, tourism focused boutiques, winery tasting rooms and via the internet to continue to tell the story of the every changing and dynamic Ohio grape and wine community. This will encourage not only additional visitation to winery locations, but increase the general public's awareness of the importance of wineries as tools to generate economic growth. The 200 games are and passports are currently in distribution. We do not have results yet from the surveys sent.

Beneficiaries:

This project launched an awareness program which impacted over 1650 children and provided them knowledge of the importance of viticulture in their region.

Ninety three wineries representing more than two thousand employees will benefit from the additional business generated by this project.

If only 4 people play the game once, over 800 will learn about the industry, grape growing, individual wineries and wine making techniques by answering the questions in the game.

While the numbers as reported above reflect the direct and immediate impact of the project, the resources provided by this grant have helped to launch three programs which will be carried several years into the future, hence a doubling, tripling, or even quadrupling of their impact in the next 2-3 years.

Economic impact projections based on extremely conservative estimates:

If each of the 93 wineries sees just 5 new/additional visitors who purchase once case of wine in the next 12 months, with an average bottle price of $10.50 or $126 per case, the economic impact will exceed $55,000.

If each of the 800 people who play the game once learns something to drive them to a winery and they visit at least 10 wineries in the next year and purchase 4 bottles at each, the economic impact will exceed $30,000.

If half of those 1730 potential travelers spend one night as they travel, at an average room rate of $100, the economic impact would exceed $85,000. If half ate a meal at $20 per person, they would spend over $15,000.

- Grape Juice project
  - Local classroom teachers now have tools to share the story and importance of the regional grape community with their students
  - Students will learn more about how growing grapes is important to their region
  - Homeschoolers will have a ready resource for lesson plans about an important regional agricultural commodity
- QR code project
  - Smaller family wineries with limited marketing budgets will have additional tools with which to promote their project
  - The industry at large has developed a cadre of tools to share both with general consumers and with various media outlets, thus driving additional traffic, especially from among the desired demographic [millennials and gen Xers] to their doors
  - The general consumer will have a series of tools ready to increase their wine knowledge and appreciation.
  - The target demographic will have, in a format they most favor, a way to access information about wineries, vineyards and wine tourism
- Trivia game
  - Consumers of all ages will have their wine and vineyard knowledge expanded exponentially with the 400+ questions created especially for the game
  - The game will provide a tool through which existing wine consumers will share their knowledge and enthusiasm with those who would be invited to play the game but would not otherwise be aware of the breadth and depth – and economic importance – of the state grape and wine community
  - The Passport component will directly drive consumers' to winery doors and enhance the opportunity for them to increase their revenues
  - The industry at large will have a tool to help drive media stories

Lessons Learned:

Grape Juice Project: emerging consumer group

We continued to find resistance on the part of teachers in several schools beyond traditional 'wine producing regions' regarding the promotion of 'alcohol' to second graders. Our instance that it was a grape juice project was counterbalanced by the name of the association which included the word 'wine.' Going forward, we will focus more on the regions were grapes and wine are more a part of the local culture vs. those areas where there are no vineyards in the area.

QR and podcast -- Fringe Consumer Group

Based in informal conversations with other organizations using YouTube video formats, it was decided to expand the 60 second format to a 2-3 minute format to provide more 'content.' Some of the wineries, despite considerable cajoling were un-cooperative in providing videos; hence the decision to create at least one for each OWPA winery and use them in the trail brochures assured we could be as broadly representative as possible. The purchase of the number of thumb drives originally outline in the grant was deemed unnecessary and a smaller number werel be purchased to be used for direct consumer requests – and to share with the media during other state promotions [e.g., Wine Month, special trail events, etc.] to drive more visitation to the web sites where additional videos and information is available to the more than 4 million unique visitors a year, who visit the www.OhioWines.org site.

Trivia game -- Foundation Consumer Group

The number of questions we researched to much longer than expected, then honing them ot a workable number proved to be much more complex than anticipated …and it was decided that the 4 categories' questions [winemaking, grape growing, wine appreciation and Ohio winery specific information] should be limited to no more than120-140 each. It was also decided that the Passport should be more broadly distributed, including via electronic communications to generate more consumer participation and attract and strengthen more media interest.

Contact Information:
Contact: Donniella Winchell
800-227-6972
dwinchell@OhioWines.org

Project Title: State-wide Weed Control Initiative for Ohio Nurseries

Project Summary:

Over 225 herbicide trials were set up in fields or containers at seven nurseries: Studebaker Nurseries, New Carlisle, OH; Willoway Nurseries, Inc., Avon, OH and Willoway Nurseries, Inc., Huron, OH; North Branch Nursery, Pemberville, OH; Klyn Nurseries, Perry, OH; Sunleaf Nursery, LLP, Madison, OH; and Herman Losely & Son, Inc., Perry, OH. Nursery visits were conducted between October 28, 2011 and November 15, 2011 to determine current weed problems and crops, herbicide management practices and problems. These meetings determined which herbicides and crops would be evaluated in the 2012 season. Products were chosen to address their current issues and concerns. The total financial impact of these 225 trials is estimated at $10 Mn due to savings in four key areas, reduction in crop losses, proper herbicide use, marketing the crop sooner and reduction in cultivation, weeding and postemergence herbicide use.

Of the seven nurseries interviewed, none were satisfied with their current herbicide programs. Two sites were experiencing major issues in their container production thought to be related to over use of inhibitors of microtubule assembly (Weed Science Society of America (WSSA) Group 3 herbicides). The Group 3 herbicides (ex. the dinitroaniline (DNA) herbicide family) (or

mitosis inhibitors) represent the majority of the herbicides labeled for nursery and landscape use. Group 3 herbicides are classified as shoot inhibitors and root inhibitors; both have the same mode of action (MoA). These two sites had incurred over $1 million (Mn) in crop losses in 2011 due to lack of rooting, poor growth and severely stressed plants. As a result of over 81 trials at these two sites alone in 2012, we provided evidence that the $1Mn in plant losses incurred in 2011 were advanced in part by Group 3 herbicides (Fig. 1). We also helped to end a cultural practice that may have been contributing to the poor rooting and promoted the buildup of the Group 3 herbicides in the media. We also suggested a weed control program for the 2013 season that minimizes use of Group 3 herbicides while still addressing their major weed issues which they have struggled with for years. The impact of our Specialty Crop Block Grant (SCBG) work at these two sites in 2012 is estimated at $1.5 Mn per site from reduction of crop losses (Table 2).

Many nurseries we met with in fall 2011 were unaware that shoot and root inhibitors were in the same MoA. Five of the sites thought rotations between root and shoot inhibitors were rotations in MoAs. These sites were thus experiencing weed species they could not control (Fig. 2). As a result of our trials at these sites, we have provided herbicide recommendations outside their current program to control five major problem species (Table 1). Our SCGB work at these nurseries has saved $640.00 per

Fig. 1. A. Gallery + Barricade applied on *Rhododendron* 'Nova Zembla' (second row from bottom evaluated 05/03/12, 4WAT showing severe stunting. **B.** Gallery + Barricade (left to right – 2X, 1X and control) applied on *Rhododendron* 'Nova Zembla' evaluated 07/11/12, 3 months after treatment, showing progressive root injury and top stunting as rate of application increased. (Photos by: Dr. H. Mathers)

hand weeding event per acre for a total of $ 0.5 Mn per site in hand-weeding costs due to past improper herbicide choices (Table 2).

Table 1. Five common Ohio container weeds at five nurseries evaluated and controls determined for each.

Common name	**Scientific name**	**Life cycle**	**Controls**
Pennsylvania bittercress	*Cardamine pennsylvanica*	Winter annual	Snapshot
Prostrate spurge	*Chamaescyce maculata* or *Euphorbia maculata*	Summer annual	Rout, Snapshot, BroadStar
Groundsel	*Senecio vulgaris*	Winter and summer annual	BroadStar, Rout
Pearlwort	*Sagina procumbens*	Perennial	Snapshot, Rout
Northern willowherb	*Epilobium ciliatum*	Summer annual	Rout, BroadStar

One field nursery had severe weed infestations due to abandoning their controls which had relied almost exclusively on expensive hand weeding operations. Inability to employee large weeding crews due to the economic downturn and without proper herbicides, their fields became infested with weeds (Fig. 2). As a general rule, for every pound of weed growth produced, about one less pound of crop growth is produced. Many of the crops at this nursery are sold by inch of top growth achieved. As a result of our SCBG trials, we were able to recommend two new herbicide products, Tower + pendulum and Indaziflam, that were providing exceptional control 7 WAT even in this field (Fig. 2) infested with perennials with potential long-term economic impact to the crop. We estimate that our studies at this site were worth $2 Mn as a result of marketing the crop one or two years sooner due to releasing the crop from current weed pressures. The work at this site was also applied at one other nursery for a total of $4 Mn (Table 2).

Fig. 2. The two rows in the center of Taxus 'Runyon' were hoed and various herbicides were applied. Rows to the right of the photo show the lack of inherent weed control at the site. To the left of the two trial rows is a grass roadway and adjacent infested weedy beds. (Photo by: H. Mathers)

Another field nursery required more effective longer residual preemergence herbicides. They had reduced their postemergence herbicide usage over the past three years due to previous OSU research relating glyphosate to bark cracking. This nursery had been using SureGuard, a PPO inhibitor, for the past several years and needed an alternative MoA to rotate out of the PPO MoA. At this site, we were able to recommended three new herbicide alternatives that provided statistically similar or superior control to SureGuard at 10 WAT: Tower + pendulum, V-10336 at 15 or 30 oz. /ac and Barricade + Goal. We estimate that the ability to rotate chemistries at this site will be worth $0.25 Mn in reduction of supplemental cultivation and postemergence use to control break through weeds. This information was also applied at one other site for a total of $0.5 Mn (Table 2).

Table 2. Summary of the Specialty Crop Block Grant (SCBG) financial impact of 225 herbicide trials at seven nurseries in 2011-12.

Type of savings	**Amount**	**No. of sites**	**Total**
Reduction of crop losses	1.5 Mn	2	3.0 Mn
Proper herbicide	0.5 Mn	5	2.5 Mn

selection			
Market crop sooner	2 Mn	2	4.0 Mn
Reduction in cultivation, weeding and postemergence herbicides	0.25 Mn	2	0.5 Mn
Grand Total			**10 Mn**

Project Approach:

The trade and common names and manufacturers of the herbicides used are as follows: BroadStar (flumioxazin, Valent U.S.A), Indaziflam (Bayer Corp.), Tower (dimethenamid-p, BASF Corp.), Tower + Pendulum (pendimethalin, BASF Corp.), Gallery (isoxaben, Dow Agro Sciences), FreeHand (dimethenamid-p + pendimethalin, BASF Corp.), Snapshot 2.5G (isoxaben + trifluralin, Dow Agro Sciences), Biathlon (oxyfluorfen + prodiamine, OHP, Inc.), Ronstar (oxadiazon, Bayer Corp.), F6875SC (sulfentrazone +prodiamine, FMC), Gallery + Surflan (oryzalin, Dow Agro Sciences) and Gallery + Barricade (prodiamine, Syngenta). Phytotoxicity evaluations were performed at 1 WA1T (week after first treatment), 2 WA1T, 4 WA1T, 1 WA2T (weeks after second treatment), 2 WA2T, and 4WA2T. Visual ratings were performed on a scale of 0-10 with 0 being no phytotoxicity, 10 being dead, and ≤3 commercially acceptable. All liquid treatments were applied with a CO_2 backpack sprayer with a spray volume of 20 gal/ac using nozzles delivering 0.15 gal/ min/ nozzle and the nozzle spacing at 12 inches. Field plot sizes included 3 plant subsamples for tree rows or 3X 3 ft. areas for liner beds in each replication, with 4 replications/ rate for each variety. Container plots sizes included 4 replications/ treatment with 3 subsamples in each replication.

Trials were initiated at five of the seven nurseries involved in the project. On March 22, 2012 at North Branch Nursery Inc., Pemberville, OH one gallon (gal) containers of *Buxus* 'Green velvet' were applied with Tower EC, Indaziflam and Gallery + Surflan. Three gal containers of *Rosa* 'Knockout' were applied with Biathlon, Gallery + Surflan and Indaziflam. Three gal containers of *Berberis thunbergii* 'Crimson pygmy' were applied with Tower + pendulum Aqua Cap, Indaziflam and Gallery + Surflan. North Branch Nursery field rows of *Malus* 'Indian Magic' and *Ulmus* X 'Frontier' received applications of Biathlon, Tower + pendimethalin and F6875SC. Rates applied are indicated in Table 1. Field rows of *Amelanchier* X *grandiflora* 'Robin Hill', *Buxus* 'Green velvet' and *Acer rubrum* 'Red Sunset' received SureGuard 51 WDG, V-10336 61.5 WDG and Tower. Rate applied are indicated in Table 2 and 3. Treatments were reapplied on May 3, 2012.

At Willoway Nurseries Inc., Huron Farm, Huron, OH on April 4, 2012 in a polyhouse with two or three cut vents at 80 °F containers of *Rhododendron* 'Nova Zembla' (1 gal) received Tower, FreeHand, Ronstar, Snapshot, Gallery +Barricade and Tower + pendulum; *Azalea* 'Karen' (2 gal) received FreeHand, Biathlon, Ronstar, Snapshot, Gallery + Barricade and Tower + pendulum; *Ilex Xmeserveae* 'Blue Maid' (1 gal) received Indaziflam and Biathlon; *Ilex crenata* 'Sky pencil' (1 gal) received FreeHand, Indaziflam, Snapshot ,Gallery +Barricade, Biathlon and Tower + pendulum; *Spirea* 'Neon Flash' (1 gal.) received Gallery; *Weigela* 'Rainbow Sensation' (3 gal) received Tower, Gallery, Ronstar and Tower + pendulum; *Pieris* 'Red Mill' (1 gal) received

FreeHand, Gallery, Biathlon, Snapshot, Gallery + Barricade, and Tower +Pendulum; and, *Kalmia latifolia* 'Olympic Fire' (1 gal) received Gallery. Rates applied are indicated in Table 4. Treatments were reapplied on May 16, 2012.

At Willoway Nurseries Inc., Avon Farm, Avon, OH on April 4, 2012 in an open roof Erie greenhouse at 70°F containers of *Itea* 'Little Henry' (3 gal) received Gallery; *Hydrangea macrophylla* 'Endless Summer' received Indaziflam, Biathlon, Ronstar and Tower + pendulum; *Hydrangea arborescens* 'Invincible spirit' (3 gal.) and *Hydrangea paniculata* 'Limelight' (3 gal) received Indaziflam and Biathlon. Rates applied are indicated in Table 5. Cuttings of 'Endless summer' were taken June 2011, shifted to 1 gal on Aug-Sept. 2011, shifted to 3 gal on Saturday, March 31, 2012. They had received no herbicides prior to our applications on April 4. *H.* 'Limelight', and 'Invincibelle spirit' and the *Itea* were in 3 gal containers from 2011. The empty pots (3 gal) for all Indaziflam treatments used the same media as with the 'Endless Summer' and were potted on March 31, 2012. Treatments were reapplied on May 16, 2012.

At Klyn Nurseries, Inc., Perry, OH on April 12, 2012 containers of *Hemerocallis* 'Stella d oro' (1 gal) received Biathlon; *Azalea viscosum* (1 qt.) received Biathlon; *Hydrangea paniculata* 'Unique' (2 gal) received FreeHand, Tower, and Tower + pendulum; *Viburnum plicatum f. tomentosum* 'St. Keverne' (1 gal) received Indaziflam; *Buxus* 'Winter Gem' (1 qt.) and *Rosa* 'Mini rainbow'(3 gal.) received F6875SC; and *Thuja nigra* (3 gal) received Indaziflam. Klyn Nursery field *Buxus* 'Winter Gem' received Tower + pendimethalin, Indaziflam, Tower and FreeHand. Rates applied are indicated in Table 6. All applications were conducted in a polyhouse with the plastic removed at 50°F. Treatments were reapplied on May 24, 2012.

At Herman Losely & Son, Inc., Perry, OH on April 12, 2012 *Taxus* X*media* 'Tauntonii' liner beds received Biathlon, Tower + pendulum, and Indaziflam. Sensitive field materials such as *Stewartia pseudocamellia, Franklinia alatamaha* and *Fothergilla gardenia* received application of Tower, Tower + 1" of pine mulch, and Tower + pendimethalin + 1" of pine mulch. Rates applied are indicated in Table 7. Treatments were reapplied on May 24, 2012.

At Sunleaf Nursery, LLP, Madison, OH, on April 12, 2012 field rows of *Liquidambar styraciflua* 'Slender Silhoutte', *Gleditsia* 'Skycote', *Acer platanoides* 'Crimson King' and *Tilia* 'Greenspire' received applications of Biathlon, Barricade + Goal 2XL, Tower + Pendulum, SureGuard 51 WDG, V-10336 61.5 WDG and Tower 6EC. Rates applied are indicated in Table 8. All trees were planted in 2008 and were just barely budding out at time of application at 50°F. All rows were hoed previous to application. Tower + Pendulum, Biathlon, and Barricade + Goal were reapplied on May 24, 2012; the other treatments were not reapplied.

At Studebaker Nursery, New Carlisle, OH, on May 1, 2012, field rows of *Buxus* 'Green velvet', *Buxus* 'Northern Charm', and *Taxus* 'Runyon' received applications of Tower, Tower + Pendulum, Indaziflam, Gallery, F6875, and Biathlon. Liner beds of *Buxus* 'Green velvet' and *Taxus* 'Runyon' received applications of FreeHand, Tower + Pendulum, Indaziflam, and Tower. Also, on May 1, 2012, containers of *Euonymus alatus* 'Compacta' and *Viburnum* 'Jeddi' (3 gal) received indaziflam and F6875; Hydrangea paniculata 'Little lamb' (3 gal) received F6875; *Hemerocallis* 'Stella d'Oro' (1 gal) received Biathlon; and *Rosa* 'Knockout' (1 gal) received BroadStar. Treatments were reapplied on June 11, 2012.

Goals and Outcomes Achieved:

The overall goal of this SCBG was to reduce weed control costs in Ohio nurseries by targeting individual weed species as opposed to the typical shotgun approach. We also wanted to reduce the labor associated with weed control by using new targeted herbicides. We emphasized four key crops Viburnum sp., Hydrangea sp., Buxus sp. and herbaceous perennials which have seen dramatic increases in the past five years but have limited herbicide options. By emphasizing these crops we hoped to see further market expansion in these crops resulting in more and advanced jobs. Of the 225+ phytotoxicity trials conducted 75% provided ratings of commercially acceptable or 169 new herbicide options at these seven sites. Specific results are indicated below by site.

North Branch Nursery

The container trails at North Branch Nursery Inc., Pemberville, OH revealed a new herbicide being released by Bayer and OHP, Indaziflam G caused no phytotoxicity on *Buxus* 'Green velvet', *Rosa* 'Knockout' and *Berberis thunbergii* 'Crimson pygmy,' regardless of the rate applied (Table 3). Indaziflam has a similar MoA to Gallery i.e. cellulose biosynthesis (CBI). However, unlike Gallery it is long-lasting up to 150 days, meaning fewer applications are required and has a very low application rate of 0.11 lb. ai /ac and is a broad spectrum herbicide controlling grasses and broadleaf weeds. Another new herbicide Biathlon (oxyfluorfen + prodiamine) by OHP which is a low dust, uniform sized granule produced with a new - Verge technology also provided no phytotoxicity with Rose (Table 3). Biathlon controls grass and broadleaf weeds in field and container ornamentals, ground maintenance and other non-crop areas. The only significant phytotoxicity caused at North Branch was caused by a combination of Gallery + Surflan on Rose (Table 3). Gallery + Surflan is the most common preemergence herbicide combination used in the industry; however, Gallery (isoxaben) is a Group 21 herbicide that includes the herbicide family benzamide. Benzamides inhibit cell wall synthesis causing mottling and random leaf chlorosis on susceptible contacted plants (Fig. 3). The Gallery + Surflan were added in the North Branch trial as an industry standard or control. It is significant that both Indaziflam and Biathlon caused less phytotoxicity than the industry standard showing their utility as alternative herbicides.

The field trails at North Branch Nursery Inc. the industry standard SureGuard was tested against a new herbicide by Valent USA V10336 at three rates. The V-10336 provided some burn-down on pineapple weed (the primary weed in the North Branch plots) and a little bit on dandelions. In both the *Acer rubrum* and *Amelanchier* plots the V-10336 provided excellent efficacy (Tables 4 and 6) with minimal phytotoxicity (Tables 5 and 7) 10 weeks after treatment (WAT). The weed control was statistically similar to the SureGuard indicating V10336 could be used as alternative to the industry standard.

Table 3. Weed control of several herbicides on containerized ornamentals at North Branch

Nursery

Buxus 'Green velvet'

Treatment	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T	4 WA2T
Indaziflam	200 lbs.	0.2	0.0	0.7	0.3	1.0	0.4
Indaziflam	400 lbs.	0.0	0.2	1.0	0.9	1.1	0.7
Indaziflam	800 lbs.	0.3	0.2	0.6	0.4	1.1	0.8
Tower	21 oz.	0.2	0.2	0.8	2.7 **	2.5 **	1.9 **
Gallery + Surflan	1.3 lb. + 2 qt.	0.7	0.4	1.6	1.2	1.5	1.2
Untreated	--	0.2	0.0	0.7	0.3	0.7	0.3

Berberis 'Crimson Pygmy'

Treatment	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T	4 WA2T
Indaziflam	200 lbs.	0.0	0.0	0.0	0.0	0.0	0.0
Indaziflam	400 lbs.	0.0	0.0	0.0	0.0	0.1	0.0
Indaziflam	800 lbs.	0.2	0.0	0.0	0.0	0.3	0.1
Tower + Pendulum	21 oz. + 2 qt.	0.2	0.2	4.0 **	3.8 **	4.0 **	3.6 **
Gallery + Surflan	1.3 lb. + 2 qt.	0.0	0.0	3.7 **	2.8 **	3.9 **	2.1 **
Untreated	--	0.0	0.0	0.0	0.0	0.0	0.3

Rosa 'Knockout'

Treatment	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T	4 WA2T
Indaziflam	200 lbs.	0.0	0.1	0.0	0.4	0.3	0.0

Indaziflam	400 lbs.	0.2	0.5	0.0	0.1	0.1	0.0
Indaziflam	800 lbs.	0.4	1.2 * *	1.6 *	1.3 * *	1.4	1.0
Biathlon	100 lbs.	1.0 * *	1.1 * *	0.3	0.1	0.6	0.3
Gallery + Surflan	1.3 lb. + 2 qt.	3.4 * *	4.3 * *	5.2 * *	3.9 * *	4.1 * *	3.8 * *
Untreated	--	0.0	0.3	0.0	0.0	0.6	0.0

Fig. 3. Leaf crinkling mottling and random leaf chlorosis caused by the cellulose inhibitor Gallery on three gal containers *Rosa* 'Knockout.'(Photo by: H. Mathers)

Table 4. Weed control of several ornamental herbicides in the *Acer rubrum* 'Red Sunset' / *Buxus* 'Green Velvet' plots at North Branch Nursery in 2012.

Treatment	Rate/ac	1 WAT[z]	2 WAT	4 WAT	7 WAT	8 WAT	10 WAT
SureGuard	12 oz.	8.8[yx] bc	8.8 a b	8.7 a	9.2 a	9.1 a	9.2 a
V-10336	7.5 oz.	9.4 ab	7.5 c	9.1 a	9.5 a	9.3 a	9.1 a
V-10336	15 oz.	9.7 a	9.3 a b	9.3 a	9.5 a	9.6 a	9.6 a
V-10336	30 oz.	--	--	--	--	--	--

Tower	21 oz.	7.4 c	8.3 b	7.2 b	6.3 b	6.4 b	6.5 b
Untreated	--	8.9 b	9.2 a	9.3 a	0.0 c	3.9 c	2.4 c

z = weeks after treatment

y = Weed control ratings based on a 0-10 scale with 0 being no weed control and 10 perfect weed control, with ≥7 commercially acceptable.

x = Ratings followed by the same letter in the same column are not significantly different based on lsmeans (α = 0.05)

Table 5. Phytotoxicity of several ornamental herbicides on *Buxus* 'Green Velvet' when intercropped with *Acer rubrum* 'Red Sunset' at North Branch Nursery in 2012.

Treatment	Rate/ac	1 WAT[z]	2 WAT	4 WAT	7 WAT	8 WAT	10 WAT
SureGuard	12 oz.	0.5[yx]	1.1	0.5	0.4	0.5	0.9
V-10336	7.5 oz.	0.6	0.9	1.0	0.5	0.6	0.9
V-10336	15 oz.	1.0	1.3	1.7	1.5 **	1.7	2.1 *
V-10336	30 oz.	--	--	--	--	--	--
Tower	21 oz.	0.2	1.1	1.0	0.5	0.2	0.6
Untreated	--	1.1	2.0	2.5	0.0	0.9	0.9

z = weeks after treatment

y = Ratings are based on a 0-10 scale with 0 being no phytotoxicity, 10 death and ≤3 commercially acceptable.

x = Ratings followed by * and ** are significantly different from the control at specified date based on Dunnett's t-test (α = 0.10 and 0.05, respectively).

Table 6. Weed control of several ornamental herbicides in the *Amelanchier* X *grandiflora* 'Robin Hill'/ *Buxus* plots at North Branch Nursery in 2012.

Treatment	Rate	1 WAT	2 WAT	4 WAT	7 WAT	8 WAT	10 WAT
SureGuard	12 oz.	9.1 a	8.5 a	8.6 a	8.1 b	8.7 b	9.0 a

V-10336	7.5 oz.	9.4 a	8.9 a	8.4 a	8.4 ab	8.8 ab	9.0 a
V-10336	15 oz.	9.3 a	8.9 a	8.9 a	9.0 a	9.1 ab	9.3 a
V-10336	30 oz.	9.4 a	8.8 a	8.9 a	8.7 ab	9.5 a	9.4 a
Tower	21 oz.	7.5 b	6.9 b		6.1 c	5.9 c	7.3 b
Untreated	--	7.6 b	6.8 b	6.9 b	6.1 c	6.3 c	7.4 b

z = weeks after treatment

y = Weed control ratings based on a 0-10 scale with 0 being no weed control and 10 perfect weed control, with ≥7 commercially acceptable.

x = Ratings followed by the same letter in the same column are not significantly different based on lsmeans (α = 0.05)

Table 7. Phytotoxicity of several ornamental herbicides on *Buxus* 'Green Velvet' when intercropped with *Amelanchier* X *grandiflora* 'Robin Hill' at North Branch Nursery in 2012.

Treatment	Rate	1 WAT	2 WAT	4 WAT	7 WAT	8 WAT	10 WAT
SureGuard	12 oz.	0.5	0.3	0.3	0.3	0.3	0.0
V-10336	7.5 oz.	1.6 **	1.8	1.0	0.5	1.8 **	1.4 **
V-10336	15 oz.	0.9	0.9	0.6	0.5	0.5	0.4
V-10336	30 oz.	1.9 **	1.6	2.0	1.5 *	2.0 **	1.5 **
Tower	21 oz.	0.3	1.3		0.3	0.3	0.4
Untreated	--	0.0	0.3	1.7	0.0	0.0	0.1

z = weeks after treatment

y = Ratings are based on a 0-10 scale with 0 being no phytotoxicity, 10 death and ≤3 commercially acceptable.

x = Ratings followed by * and ** are significantly different from the control at specified date based on Dunnett's t-test (α = 0.10 and 0.05, respectively).

Wiiloway – Huron

The container trials at Willoway Nursery, Huron, OH, yielded a wealth of efficacy and phytotoxicity data. Tests with Ronstar showed no phytotoxicity on *Rhododendron* 'Nova Zembla,' *Azalea* 'Karen' and *Weigela* 'Rainbow Sensation' (Table 8). Gallery also caused no injury on *Spirea* 'Neon Flash' and, *Kalmia latifolia* 'Olympic Fire' (Table 8) while providing control of creeping oxalis. Most of the mitosis inhibitor MoA used at this site seemed to compound existing crop phytotoxicity problems from the previous growing season. The exception was FreeHand on *Rhododendron* 'Nova Zembla' and *Azalea* 'Karen.' *Weigela* 'Rainbow Sensation' experienced some transitory injury with increasing rates of Gallery 2WAT (Fig. 4) which disappeared by the end of the trial.

Fig. 4. Gallery (isoxaben) applied to *Weigela* 'Rainbow Sensation' at Willoway Nursery, Inc., Huron, OH showing from increasing injury with increasing rates 2WAT, left to right 4X (5.2 lb. /ac), 2X (2.6 lb. /ac) and 1X (1.3 lb. /ac). (Photo by: H. Mathers)

Table 8. Phytotoxicity of several ornamental cultivars from various herbicides at Willoway Nurseries, Huron

Azalea 'Karen'

Treatment	Rate/ac	Location	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T
FreeHand	150 lb.	Willoway Huron	0.0	0.0	0.3	0.4	0.4

FreeHand	300 lb.	Willoway		0.0		0.1		0.0		0.0		
		Huron	0.0									
FreeHand	600 lb.	Willoway		0.0		0.3		0.7		0.3		
		Huron	0.0									
Biathlon	100 lbs.	Willoway		0.0		0.1		4.1		0.0		
		Huron	0.0						**			
Biathlon	200 lbs.	Willoway		0.0		0.4		0.0		0.0		
		Huron	0.0									
Biathlon	400 lbs.	Willoway		0.0		0.5		0.0		0.5		
		Huron	0.0									
Ronstar	100 lbs.	Willoway		1.6		0.2		0.0		0.0		
		Huron	0.0		**							
Ronstar	200 lbs.	Willoway		2.0		1.0		2.3		0.8		
		Huron	0.0		**		**		**			
Snapshot	1	Willoway		0.7		0.8		4.5		0.6		
		Huron	0.0				**		**			
Snapshot	2	Willoway		2.1		0.2		0.9		0.8		
		Huron	0.0		**							
Gallery + Barricade	1.3 lb. + 21 oz.	Willoway		0.0		1.6		1.9		1.2		
		Huron	0.0				**					
Gallery + Barricade	2.6 lb. + 42 oz.	Willoway		0.0		2.5		1.8		1.5		
		Huron	0.0				**					
Tower + Pendulum	21 oz. + 2 qt.	Willoway		0.0		3.3		5.8		7.0		
		Huron	0.0				**		**			**
Untreated	--	Willoway		0.0		0.0		0.0		0.6		
		Huron	0.0									

Rhododendron 'Nova Zembla'

Treatment	Rate/ac	Location	1 WAT		2 WAT		4 WAT		1 WA2T		2 WA2T	
Tower	21 oz.	Willoway	0.6		0.0		0.5		3.0		2.8	
		Huron		*						**		**
Tower	42 oz.	Willoway	0.2		0.0		0.3		2.3		3.6	
		Huron								**		**
Tower	84 oz.	Willoway	0.3		0.0		0.3		2.8		2.6	
		Huron								**		**

FreeHand	150 lb.	Willoway	0.0	0.0		0.3		1.3	**	0.5		
		Huron										
FreeHand	300 lb.	Willoway	0.0	0.0		0.3		1.2	**	0.8		
		Huron										
FreeHand	600 lb.	Willoway	0.0	0.0		1.0		0.0		0.5		
		Huron										
Ronstar	100 lbs.	Willoway	0.0	0.0		0.3		0.0		0.0		
		Huron										
Ronstar	200 lbs.	Willoway	0.0	0.0		0.3		0.0		0.2		
		Huron										
Snapshot	1	Willoway	0.0	0.0		0.3		0.1		0.2		
		Huron										
Snapshot	2	Willoway	0.0	0.0		0.3		0.4		0.9		
		Huron										
Gallery + Barricade	1.3 lb. + 21 oz.	Willoway	0.3	3.2	**	3.6	**	0.8		2.0		
		Huron										
Gallery + Barricade	2.6 lb. + 42 oz.	Willoway	0.0	3.1	**	2.6	**	0.5		1.5		
		Huron										
Tower + Pendulum	21 oz. + 2 qt.	Willoway	0.0	2.8	**	1.1	*	2.2	**	2.8		
		Huron										
Untreated	--	Willoway	0.0	0.0		0.5		0.0		0.0		
		Huron										

Weigela 'Rainbow Sensation'

Treatment	Rate/ac	Location	1 WAT	2 WAT		4 WAT		1 WA2T		2 WA2T		
Tower	21 oz.	Willoway	1.5	2.0		0.8		0.0		1.1		
		Huron										
Tower	42 oz.	Willoway	1.7	2.0		0.8		2.1	**	2.3		
		Huron										
Tower	84 oz.	Willoway	1.9	1.8		0.5		3.3	**	2.4		
		Huron										
Gallery	1.3 lb.	Willoway	0.2	2.9	**	0.4		0.5		0.0		
		Huron										
Gallery	2.6 lb.	Willoway	1.8	2.7	**	0.7		1.5		1.8		
		Huron										

Gallery	5.2 lb.	Willoway	4.0		3.8		1.3	1.9	1.6
		Huron		**		**			**
Ronstar	100 lbs.	Willoway	1.6		3.3		1.0	1.5	0.4
		Huron				**			
Ronstar	200 lbs.	Willoway	1.3		3.8		1.4	1.3	1.1
		Huron				**		**	
Tower + Pendulum	21 oz. + 2 qt.	Willoway	0.0		2.8		0.9	2.9	2.2
		Huron				**			**
Untreated	--	Willoway	1.7		1.2		0.3	0.0	1.3
		Huron							

Spirea ‘Neon Flash'

Treatment	Rate/ac	Location	1 WAT		2 WAT		4 WAT	1 WA2T	2 WA2T
Gallery	1.3 lb.	Willoway	1.1		0.0		1.9	1.2	1.6
		Huron					*		
Gallery	2.6 lb.	Willoway	2.0		0.8		0.9	2.7	1.8
		Huron		**					**
Gallery	5.2 lb.	Willoway	0.4		0.0		1.3	3.3	1.3
		Huron							**
Untreated	--	Willoway	0.3		0.0		0.5	0.0	0.3
		Huron							

Kalmia latifolia 'Olympic Fire'

Treatment	Rate/ac	Location	1 WAT		2 WAT		4 WAT	1 WA2T	2 WA2T
Gallery	1.3 lb.	Willoway	2.3				0.1		
		Huron			0.0			0.0	0.0
Gallery	2.6 lb.	Willoway	4.0				1.2		
		Huron		**	0.0			** 0.0	0.0
Gallery	5.2 lb.	Willoway	3.2				0.4		
		Huron			0.0			0.0	0.0
Untreated	--	Willoway	2.4				0.1		
		Huron			0.0			0.0	0.0

Pieris 'Red Mill'

Treatment	Rate/ac	Location	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T

FreeHand	150 lb.	Willoway			0.3	0.0	
		Huron	0.0	0.0			0.0
FreeHand	300 lb.	Willoway			0.0	0.0	
		Huron	0.0	0.0			0.0
FreeHand	600 lb.	Willoway			0.2	0.0	
		Huron	0.0	0.0			0.0
Gallery	1.3 lb.	Willoway			0.8	0.0	
		Huron	0.0	0.0	**		0.0
Gallery	2.6 lb.	Willoway			0.1	0.0	
		Huron	0.0	0.0			0.0
Gallery	5.2 lb.	Willoway			0.3	0.0	
		Huron	0.0	0.0			0.0
Biathlon	100 lbs.	Willoway			0.0	0.0	
		Huron	0.0	0.0			0.0
Biathlon	200 lbs.	Willoway			0.2	0.0	
		Huron	0.0	0.0			0.0
Biathlon	400 lbs.	Willoway			0.1	0.0	
		Huron	0.0	0.0			0.0
Snapshot	150	Willoway			0.1	0.0	
		Huron	0.0	0.0			0.0
Snapshot	300	Willoway			0.2	0.0	
		Huron	0.0	0.0			0.0
Gallery + Barricade	1.3 lb. + 21 oz.	Willoway			0.5	0.0	
		Huron	0.0	0.0	*		0.0
Gallery + Barricade	2.6 lb. + 42 oz.	Willoway Huron	0.0	0.0	0.2	0.0	0.0
Tower + Pendulum	21 oz. + 2 qt.	Willoway Huron	0.0	0.0	2.6 **	2.0 **	0.0
Untreated	--	Willoway Huron	0.0	0.0	0.0	0.0	0.0

*** no phyto on Ilex merservea from indaziflam or biathlon

The addition of Barricade to Gallery caused severe shoot inhibition on *Rhododendron* 'Nova Zembla' up to 4WAT (Fig. 1A) (Table 8). Although the shoot inhibition had disappeared by the end of the trial (Table 8) an examination of the roots showed severe stunting still persisted into July (Fig. 1B).

Fig. 5. Photo taken 07/11/12 at Willoway Nursery, Huron, OH showing increasing root inhibition on *Weigela* 'Rainbow Sensation' with increasing rates caused by Tower applied at 1X (right) (21 oz. /ac) and 2X (middle) (42 oz. /ac). The control is shown in the top left corner. (Photo by: H. Mathers)

Tower applied to *Weigela* 'Rainbow Sensation' also caused some shoot inhibition after the second application that seemed to be fading by the end of the trial (Table 8); however, again an examination of the roots in July showed root inhibition was persisting and was greater at the 2X rate versus the 1X rate (Fig. 5). Tower + pendulum also caused shoot inhibition to *Rhododendron* 'Nova Zembla' which after the second application was increasing in severity (Table 8 and Fig. 6). The *Pieris* 'Red Mill' and *Ilex* 'Sky pencil' never grew out of the phytotoxicity problems that had impacted them the season before. An examination of the roots showed acute stunting on all plants. As a result, the SCBG herbicide treatment effects were impossible to determine.

Fig. 6. *Rhododendron* 'Nova Zembla' at Willoway Nursery, Huron, OH the plant on the right was sprayed Tower + pendulum at 21oz + 2 qt, /ac and is exhibiting shoot inhibition.

Although FreeHand caused minimal injury in this trial it had little efficacy on three of this nurseries worst weeds including bittercress, marestail and groundsel. Tower was also ineffective on groundsel and pearlwort.

Willoway – Avon

The container trials at Willoway Nursery, Avon, OH showed no phytotoxicity with Ronstar (Fig. 8A) and Biathlon (Fig. 8B) (with one application) on *Hydrangea macrophylla* 'Endless Summer' (Fig. 8A), Gallery on *Itea* 'Little Henry,' Indaziflam (at 200 lbs. /ac) on *Hydrangea paniculata* 'Limelight' and Biathlon on with *Hydrangea arborescens* 'Invincibelle spirit.' However, Indaziflam was phytotoxic to *Hydrangea macrophylla* 'Endless Summer' (Fig. 8A and B) and *Hydrangea arborescens* 'Invincibelle spirit' (Table 9). The injury from the Indaziflam was worse than from the Biathlon causing after the second application almost total kill at the highest rate of 800 lbs. /ac (Table 9, Fig. 7).

Fig. 7. (right) *Hydrangea macrophylla* 'Endless Summer' 1WA2T, 05/17/12, applied with Indaziflam 800 lbs. /ac. (Photo by: H. Mathers).

Fig. 8 A. Indaziflam (left) and Ronstar (right) on *Hydrangea macrophylla* 'Endless Summer' 2WAT showing stunting and leaf malformation caused by the 1X rate (200 lbs. /ac) vs. no injury from Ronstar at 2X (200 lbs. /ac). **B.** Indaziflam (left) and Biathlon (right) on *Hydrangea macrophylla* 'Endless Summer' 2WAT showing stunting, chlorosis, leaf puckering and malformation caused by the 4X rate (800 lbs. /ac) vs. no injury from Biathlon at 1X (100 lbs. /ac). (Photos by: H. Mathers).

Biathlon did cause injury cause injury after the second application at all rates (Fig. 9 A and B). The growing points experienced significant injury where the granules were retained in the top foliage (Fig. 9 A and B).

Fig. 9 A. and B. Biathlon on *Hydrangea macrophylla* 'Endless Summer' 2 weeks after the second application (2WA2T) showing stunting, chlorosis and injury to the growing point **(B)** caused by the 2X rate (200 lbs. /ac). (Photos by: H. Mathers).

Tower + pendulum (21 oz. + 2 qt., respectively) also caused damage to *Hydrangea macrophylla* 'Endless Summer' which increased after the second application (Table 9, Fig. 10).

Fig. 10. Tower + pendulum (21 oz. + 2 qt., respectively) were causing leaf and growing point deformation on *Hydrangea macrophylla* 'Endless Summer' at Willoway Nursery, Avon, OH 2WAT. (Photo by: H. Mathers),

As indicated above Indaziflam was also injurious on *Hydrangea arborescens* 'Invincibelle spirit' at all rates and *Hydrangea paniculata* 'Limelight' at high rates (2X and 4X) (Table 9). Although damaged occurred at all rates for 'Invincibelle spirit,' it was most severe at the 4X rate (800 lbs. /ac) (Fig. 11). Damage to 'Limelight' was also most severe at the 4X rate (800 lbs. /ac) (Fig. 12).

Fig. 11. (left) *Hydrangea arborescens* 'Invincibelle spirit' 2WA2T of 1X rate (200 lbs. /ac) (left) and 800 lbs. /ac) (right) applied with Indaziflam showing severe stunting, chlorosis and leaf malformation. (Photo by: H. Mathers).

Fig. 12. (right) *Hydrangea paniculata* 'Limelight' 2WAT application of 4X rate (800 lbs. /ac) of Indaziflam showing chlorosis, necrosis, leaf puckering and malformation. (Photo by: H. Mathers).

Table 9. Phytotoxicity of several ornamental cultivars from various herbicides at Willoway Nurseries, Avon, OH.

Itea 'Little Henry'

Treatment	Rate/ac	Location	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T	
Gallery	1.3 lb	Willoway Avon	1.8	2.6	0.4	0.9	2.4	*
Gallery	2.6 lb	Willoway Avon	1.4	1.3	0.5	0.9	2.0	
Gallery	5.2 lb	Willoway Avon	2.1	2.5	0.6	0.9	2.8	**
Untreated	--	Willoway Avon	1.7	2.2	0.0	0.2	0.9	

Hydrangea 'Endless Summer'

Treatment	Rate/ac	Location	1 WAT		2 WAT		4 WAT		1 WA2T		2 WA2T	
Tower	21 oz	Willoway Avon	0.0		0.0		0.4		0.7		3.8	**
Tower	42 oz	Willoway Avon	0.0		0.0		0.8		1.0		4.8	**
Tower	84 oz	Willoway Avon	0.0		0.2		1.4		0.8		5.7	**
Indaziflam	200 lbs	Willoway Avon	0.9		2.6	**	3.8	**	3.5	**	5.5	**
Indaziflam	400 lbs	Willoway Avon	2.1	**	3.2	**	4.3	**	4.8	**	7.8	**
Indaziflam	800 lbs	Willoway Avon	3.3		5.1	**	5.2	**	6.3	**	9.1	**
Biathalon	100 lbs	Willoway Avon	0.4		0.2		0.3		0.7		3.5	
Biathalon	200 lbs	Willoway Avon	1.1	*	1.2	**	1.4		1.0		3.6	*
Biathalon	400 lbs	Willoway Avon	0.5		0.2		0.7		1.2		3.5	
Ronstar	100 lbs	Willoway Avon	1.1	*	0.9	*	1.3		0.9		5.4	**
Ronstar	200 lbs	Willoway Avon	1.7	**	1.7	**	2.5	**	1.1		4.6	**
Tower + Pendulum	21 oz + 2 qt	Willoway Avon	2.5	**	3.1	**	3.8	**	2.7	**	5.9	**
Untreated	--	Willoway Avon	0.3		0.1		0.7		0.6		2.2	

Hydrangea 'Invincibelle'

Treatment	Rate/ac	Location	1 WAT	2 WAT		4 WAT		1 WA2T		2 WA2T	
Indaziflam	200 lbs	Willoway Avon	0.0	1.5	**	1.7	**	1.8	**	3.5	**
Indaziflam	400 lbs	Willoway	0.0	4.4	**	3.2	**	3.1	**	5.6	**

		Avon										
Indaziflam	800 lbs	Willoway		5.5	**	4.0	**	4.0	**	6.2	**	
		Avon	0.0									
Biathalon	100 lbs	Willoway		0.0		0.1		1.3		2.5	**	
		Avon	0.0									
Untreated	--	Willoway		0.0		0.1		0.5		1.1		
		Avon	0.0									

Hydrangea 'Limelight'

Treatment	Rate/ac	Location	1 WAT	2 WAT		4 WAT		1 WA2T		2 WA2T	
Indaziflam	200 lbs	Willoway	1.8	2.3	**	0.8	**	0.8	**	0.0	
		Avon									
Indaziflam	400 lbs	Willoway	3.8	4.3	**	3.0	**	1.7	**	1.5	**
		Avon									
Indaziflam	800 lbs	Willoway	5.3	5.3	**	3.7	**	2.3	**	2.8	**
		Avon									
Biathalon	100 lbs	Willoway	0.0	0.0		0.0		0.3		0.0	
		Avon									
Untreated	--	Willoway	0.0	0.0		0.0		0.0		0.0	
		Avon									

Klyn Nursery

The container trials at Klyn's indicated many of the products tested provided minimal damage to the selected crops and may be used as alternative herbicides. Biathlon provided no significant phytotoxicity with *Azalea viscosum* or *Hemerocallis* 'Stella d oro' (Table 10). Applications of FreeHand and Tower provided no significant phytotoxicity with *Hydrangea paniculata* 'Unique' (Table 10). Indaziflam was acceptable on *Viburnum plicatum f. tomentosum* 'St. Keverne' and F6875SC was acceptable on *Buxus* 'Winter Gem' and *Thuja nigra* (Table 10). Damage did occur on *Rosa* 'Mini Rainbow' following applications of F6875SC which included significant burning of foliage with increasing rates (Fig. 13 and Table 10) and continued as stunting for the remainder of the trial.

Fig. 13. F6875SC applied on *Rosa* 'Mini Rainbow' at Klyn Nursery from left to right control, 1X (0.375 lb. /ac), 2X (0.75 lb. /ac) and 4X (1.5 lb. /ac) showing increasing damage with increasing rate. (Photo by: H. Mathers).

The only other crop that was damaged at Klyn's was *Hydrangea paniculata* 'Unique' following applications of Tower + pendulum (Fig.14). The Tower + pendulum resulted in significant stunting that persisted for the life of the trial (Table 10).

Fig. 14. *Hydrangea paniculata* 'Unique' left is a control plant and right is plant that received an application of Tower + pendulum (21 oz. + 48 oz., respectively). Photo by: H. Mathers.

Table 10. Phytotoxicity of several herbicides on selected containerized ornamentals at Klyn Nursery.

Azalea viscosum

Trmt	Rate/ac	1 WAT		2 WAT		4 WAT		1 WA2T		2 WA2T	4 WA2T
Biathalon	100 lbs	0.4		0.0		0.0		3.8	**	--	0.0
Biathalon	200 lbs	0.0		0.0		0.0		3.8	**	--	0.0
Biathalon	400 lbs	3.8	**	0.0		3.2	**	4.3	**	--	0.0
Untreated	--	0.0		0.0		0.0		2.0		--	0.1

Hemerocallis 'Stella d'Oro'

Trmt	Rate/ac	1 WAT		2 WAT		4 WAT	1 WA2T	2 WA2T	4 WA2T
Biathalon	100 lbs	0.0		3.1		0.0	0.0	--	0.3
Biathalon	200 lbs	0.0		3.3		0.0	0.0	--	0.1
Biathalon	400 lbs	1.1	**	3.0		0.0	0.0	--	0.2
Untreated	--	0.0		3.3		0.0	0.0	--	0.1

Viburnum p. 'St. Veverne'

Trmt	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T	4 WA2T
Indaziflam	200 lbs	2.4	2.9	3.2	3.1	--	--
Indaziflam	400 lbs	2.8	1.6	2.8	3.3	--	--
Indaziflam	800 lbs	4.3	2.3	3.3	3.6	--	--
Untreated	--	3.4	1.9	2.5	2.9	--	--

Hydrangea p. 'Unique'

Trmt	Rate/ac	1 WAT		2 WAT		4 WAT		1 WA2T		2 WA2T	4 WA2T
FreeHand	150	0.0		0.2		0.0		1.0		--	1.0
FreeHand	300	0.0		0.2		0.0		2.3	**	--	0.8
FreeHand	600	0.0		0.6		0.0		3.3	**	--	0.4
Tower	21 oz	0.5		1.9	**	1.5	**	6.0	**	--	0.6

Tower	42 oz	0.0		0.6		1.3	*	0.0		--		0.7	
Tower + Pendulum	21 oz + 48 oz	5.3	**	3.8	**	4.3	**	5.7	**	--		3.4	**
Tower + Pendulum	42 oz + 96 oz	2.5	**	0.9	*	2.3	**	0.0		--		1.0	
Untreated	--	0.0		0.2		0.0		0.0		--		0.2	

Rosa 'Mini Rainbow'

Trmt	Rate/ac	1 WAT		2 WAT		4 WAT		1 WA2T		2 WA2T		4 WA2T	
F6875	0.375 lb ai	5.4	**	4.3	**	4.6	**	0.3		--		4.4	
F6876	0.75 lb ai	6.7	**	4.9	**	5.3	**	1.2	**	--		4.4	
F6877	1.5 lb ai	7.8	**	6.3	**	7.2	**	2.1	**	--		4.4	
Untreated	--	0.0		1.3		1.3		0.2		--		4.6	

Buxus 'Winter Gem'

Trmt	Rate/ac	1 WAT		2 WAT		4 WAT	1 WA2T	2 WA2T		4 WA2T	
F6875	0.375 lb ai	1.6		0.8		0.0	0.0	--		0.0	
F6875	0.75 lb ai	2.7	**	0.9		0.0	0.0	--		0.4	
F6875	1.5 lb ai	3.9	**	1.8	**	0.0	0.0	--		0.8	
Untreated	--	0.0		0.0		0.0	0.0	--		0.3	

Thuja nigra

Trmt	Rate/ac	1 WAT		2 WAT	4 WAT	1 WA2T	2 WA2T		4 WA2T
Indaziflam	200 lbs	0		0	0	0	--		0
Indaziflam	400 lbs	0		0	0	0	--		0
Indaziflam	800 lbs	2.5	**	0	0	0	--		0
Untreated	--	0		0	0	0	--		0

Losely Nursery

Field trials at Herman Losely & Son, Inc., Perry, OH showed little results (Table 11). There was little weed pressure during the time period of the trial and thus efficacy ratings were high even in the controls. All products tested resulted less phytotoxicity than the control (Table 11).

Table 11. Phytotoxicity and efficacy of several herbicides on *Taxus 'Runyon'* at Losely Nursery

		2 WA1T		4 WA1T		1 WA2T		2 WA2T		4 WA2T		
Treatment	Rate/ac	Phyto	Eff	Phyto	Eff	Phyto	Eff	Phyto	Eff	Phyto	Eff	
Biathalon	100 lbs	0.3	9.8	2.0	10.0	0.8	10.0	0.0	9.8	0.0	8.8	ab
Tower + Pendulum	21 oz + 2 qt	0.0	9.8	1.8	9.8	0.0	10.0	0.0	10.0	2.5 **	10.0	a
Indaziflam	200 lbs	0.0	10.0	1.8	10.0	1.0	10.0	0.5	10.0	0.0	10.0	a
Untreated	--	1.0	9.3	2.8	9.0	2.3	8.5	1.8	8.3	0.0	7.5	b

Sunleaf Nursery

Field trials at Sunleaf Nursery, LLP, Madison, OH revealed no phytotoxicity. SureGuard (12 oz. /ac) and V-10336 (30 oz. /ac) both provided commercially acceptable weed control after 10 weeks (Table 12). Despite reapplications at 6WAT of Biathlon (200 lbs. /ac), Barricade + Goal and Tower + pendulum these products provided below commercially acceptable control at 10 WAT. However, Biathlon (200 lb /ac) applied in the November 2011 provided excellent control into May 2012 (data not shown). Averaged over all evaluation dates Barricade +Goal also provided commercially acceptable control in these spring trials (Fig.15) as did Tower + Pendulum both of these products could be considered as alternative products to SureGuard in this operation.

Table 12. Weed control of several ornamental herbicides in a field setting at Sunleaf Nursery near Madison, OH in 2012.

Treatment	Rate/ac	1 WAT[z]	2 WAT	4 WAT	7 WAT	8 WAT	10 WAT
Biathalon✓	200 lbs	8.5[yx] bc	8.0 abcd	5.8 d	4.3 d	3.3 d	3.2 D
Barricade + Goal✓	21 oz + 48 oz	9.4 a	8.5 ab	7.0 cd	7.0 ab	6.8 ab	6.3 b
Tower + Pendulum✓	21 oz + 64 oz	8.9 abc	7.8 bcd	8.5 ab	7.5 a	6.8 ab	6.5 B

SureGuard	12 oz	8.4	bc	8.3	abc	7.5	bc	7.9	a	7.1	ab	7.4	ab
V-10336	7.5 oz	8.4	bc	7.5	cd	6.8	cd	5.4	c	4.2	d	4.3	cd
V-10336	15 oz	8.8	abc	8.2	abc	7.3	bc	7.1	ab	6.0	bc	6.7	ab
V-10336	30 oz	9.1	ab	8.7	a	9.0	a	8.3	a	7.8	a	8.1	A
Tower	21 oz	8.6	bc	7.9	bcd	6.4	cd	5.7	bc	4.4	cd	4.8	C
Untreated	--	8.2	c	7.3	d	6.2	cd	5.2	c	3.5	d	1.4	E

✓ indicates product was reapplied at 6 WAT

z = weeks after treatment

y = Ratings are based on a 0-10 scale with 0 being no weed control, 10 perfect weed control and ≥7 commercially acceptable.

x = Ratings followed by * and ** are significantly different from the control at specified date based on Dunnett's t-test ($\alpha = 0.10$ and 0.05, respectively).

Fig. 15. Goal + Barricade (21 + 48 oz. /ac) (10 WAT) (left) (rating 6.3) compared to Biathlon 200 lbs. /ac (10 WAT) (right) (rating 3.2) at Sunleaf Nursery, Madison, OH. (Photos by: L. Case).

Studebaker Nursery

Container, field rows (Fig. 2 and 16) and liner bed trials were conducted at Studebaker Nurseries, New Carlisle, OH. All products tested in field rows showed minimal or no persisting injury (Table 13) and more efficacious than their controls (Table 13).

Table 13. Phytotoxicity and weed control of several herbicides on field rows of *Taxus* 'Runyon' and two cultivars of *Buxus* at Studebaker Nursery.

Taxus 'Runyon'

Trmt	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T
Tower	21 oz	0	0	0.25	0.625	0.5

Tower	42 oz	0	0	0	1.25	1
Tower + Pendulum	21 oz + 2 qt	1.25	0.5	0	1.125	1.625
Indaziflam	200 lbs	0.5	0.25	0.25	0.75	0.5
Gallery	1 lb	1	0.25	1	2.5 **	3.125 **
Gallery	2 lb	0.278	2.78E-17	0.25	1.125	1.375
F6875	0.375 lb ai	0.278	0.5	0.278	0.375	0.375
Biathalon	100 lbs	0.75	0.75	0.75	1.5	0.25
Untreated	--	0	0	0	0.625	0.625

Buxus 'Green velvet'

Trmt	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T
Tower	21 oz	--	2.6667	2.6667	1.5	0.625
Tower	42 oz	--	1	1.3333	2.3333	0.25
Tower + Pendulum	21 oz + 2 qt	--	2.3333	2.25	1.75	0.5
Indaziflam	200 lbs	--	2.5	2.25	2.125	0.875
Gallery	1 lb	--	3	2.5	3	1
Gallery	2 lb	--	2	2.5	2.6667	2.5
F6875	0.375 lb ai	--	2.25	2	1.375	0.375
Biathalon	100 lbs	--	2.75	2.5	3	2
Untreated	--	--	2.75	2.5	1.375	0.5

Buxus 'Northern charm'

Trmt	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T
Tower	21 oz	3.5	4.5	1.5	1.125	0
Tower	42 oz	4.25	4.75	2.75	2.125	0.5
Tower + Pendulum	21 oz + 2 qt	4	4.5	2.75	1.25	0.625
Indaziflam	200 lbs	5	5.5	2.5	1.25	1
Gallery	1 lb	4.25	4.75	3	2	1.125
Gallery	2 lb	3.25	4.75	1.5	1.625	1

F6875	0.375 lb ai	3.6667	3.75	2	1.75	0.25
Biathalon	100 lbs	5	5.25	3.5	2.25	1
Untreated	--	4.5	5	3	1.875	0.5

Weed control

Trmt	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T
Tower	21 oz	8.8 ab	8.5 a	8.0 a	6.6 a	5.9 a
Tower	42 oz	9.4 a	8.0 ab	7.2 ab	5.4 a	5.3 a
Tower + Pendulum	21 oz + 2 qt	9.1 ab	7.5 ab	5.5 b	5.2 a	4.8 a
Indaziflam	200 lbs	9.0 ab	7.4 ab	6.3 ab	5.7 a	4.9 a
Gallery	1 lb	8.5 bc	7.6 ab	6.9 ab	6.0 a	5.6 a
Gallery	2 lb	9.1 ab	7.6 ab	6.7 ab	6.1 a	6.1 a
F6875	0.375 lb ai	8.9 ab	7.9 ab	6.8 ab	5.3 a	4.5 a
Biathalon	100 lbs	6.8 d	6.7 ab	6.4 ab	5.6 a	5.4 a
Untreated	--	6.9 cd	6.3 b	5.3 b	8.6 b	8.4 b

Three products provided an average efficacy over all evaluation dates of seven or higher (commercially acceptable, Gallery 2 lbs. /ac (Fig. 16), Tower 21 oz. /ac and Tower 42 oz. /ac. Because the weed pressure was so high on these sites these three products should all be considered commercially viable herbicide alternatives.

Fig. 16. Gallery 2 lbs. /ac applied at Studebaker Nursery, New Carlisle, OH on Taxus 'Runyon' showing exceptional weed control 2 WAT. (Photo by: H. Mathers).

Over all evaluation dates Tower + Pendulum (21 oz. + 2 qt. /ac) provided excellent weed control in *Buxus* and *Taxus* liner beds at Studebaker's. The granule version of Tower + Pendulum (FreeHand -200 lbs. /ac) also performed very well up to 4 WAT (Fig. 17) when it dropped just below commercially acceptable (Table 14).

Table 14. Phytotoxicity and weed control of several herbicides in *Taxus* and *Buxus* liner beds at Studebaker Nursery

Taxus 'Runyon'

Trmt	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T
FreeHand	200 lbs	1	0.75	1.75	1	0.25
Tower + Pendulum	21 oz + 2 qt	1	2	2.3333	2.75 **	2.25 **
Indaziflam	200 lbs	0	0.75	2.75	1.5	1.75 **
Tower	21 oz	0.5	1.25	2.25	0.75	0.5
Untreated	--	1	1.5	1	0.5	-1.11E-16

Buxus 'Green Velvet'

Trmt	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T
FreeHand	200 lbs	1	1	0.5	0.5	0.25
Tower + Pendulum	21 oz + 2 qt	1	0.75	1.25 **	1	0.75
Indaziflam	200 lbs	0	0.5	0	1.5	1
Tower	21 oz	0.5	0.75	0.5	0.5	0.75
Untreated	--	1	0.25	8.33E-17	0.5	1

Weed control

Trmt	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T
FreeHand	200 lbs	8.9 ab	7.5 bc	6.5 bc	6.0 ab	5.5 a b
Tower + Pendulum	21 oz + 2 qt	9.9 a	9.9 a	9.0 a	6.8 a	6.6 a
Indaziflam	200 lbs	9.1 ab	8.4 b	7.0 bc	6.6 a	6.4 a b

Tower	21 oz	8.3	b	8.0	bc	6.4	bc	5.0	b	4.9	b
Untreated	--	8.8	ab	7.0	c	5.5	c	2.0	c	1.3	c

Fig. 17. FreeHand applied at (200 lbs. /ac) (left) compared to control at 2 WAT in Studebaker Nursery liner beds. Note the control is showing emergence of several problematic weeds including bindweed and Marestail which are being controlled by the FreeHand application. (Photo by: H. Mathers)

The container trials at Studebaker indicated that Indaziflam could be used at all rates without injury on *Euonymus alatus* 'Compacta' and at the 1X rate of 200 lbs. /ac on *Viburnum* X'Juddi' (Table 15). Increasing the rate on *Viburnum* resulted in significant leaf deformation (Fig. 18). F6875SC was non-injurious to *Euonymus alatus* 'Compacta'; however, it was very injurious to Viburnum X'Juddi' (Fig. 19) and *Hydrangea paniculata* 'Little Lamb' (Fig. 20) (Table 15). Biathlon provided significant injury on Hemerocallis 'Stella d'oro' at the 1X rate (Fig. 21); however, the plants seemed to be growing out of the injury by the end of the trial (Table 15). *Rosa* 'Knock out,' and *Taxus* 'Runyon' experienced no injury from Biathlon and Tower, respectively (data not shown). The *Buxus* 'Green velvet' experienced significant frost injury during the trial period and treatment effects from Indaziflam were indiscernible (data not shown).

Table 15. Phytotoxicity of several herbicides on containerized ornamentals at Studebaker Nursery

Euonymus alatus
'Compacta'

Trmt	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T
Indaziflam	200 lbs	0.0	0.0	3.1 **	0.2	1.1
Indaziflam	400 lbs	0.0	0.0	3.3 **	0.1	0.3

Indaziflam	800 lbs	0.0	0.0	4.4 **	1.1 **	0.8
F6875	0.375 lb ai	0.0	0.0	0.8	0.2	0.3
F6875	0.75 lb ai	0.0	0.0	0.8	0.1	0.3
F6875	1.5 lb ai	0.0	0.0	0.8	0.1	0.3
Untreated	--	0.0	0.0	1.1	0.2	0.5

Viburnum 'Juddi'

Trmt	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T
Indaziflam	200 lbs	0.5	0.7	1.2	0.9	0.2
Indaziflam	400 lbs	2.3	2.3	1.3	1.5	1.6
Indaziflam	800 lbs	5.6 **	6.1 **	5.0	4.0 **	4.0
Untreated	--	0.3	0.4	0.7	0.5	1.3

Hydrangea paniculata 'Little lamb'

Trmt	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T
F6875	0.375 lb ai	6.9 **	7.3 **	6.9 **	2.8 **	1.6 **
F6875	0.75 lb ai	7.6 **	7.7 **	7.9 **	3.5 **	2.5 **
F6875	1.5 lb ai	8.3 **	8.5 **	8.3 **	4.1 **	3.9 **
Untreated	--	0.0	0.0	0.0	0.0	0.0

Hemerocallis 'Stella d'oro'

Trmt	Rate/ac	1 WAT	2 WAT	4 WAT	1 WA2T	2 WA2T
Untreated		0.0	0.0	0.0	0.3	0.4
Biathlon	100lbs	4.1 **	6.0 **	6.2 **	2.3 *	1.3 *

Fig. 18. Indaziflam 4X (800 lbs. /ac) applied on to *Viburnum* X'Juddi' caused significant leaf deformation at Studebaker Nursery 4 WAT. (Photo by: H. Mathers).

Fig. 19. F6875SC 4X (1.5 lb. /ac) (right) applied on *Viburnum* X'Juddi' showing significant leaf and growing point deformation versus the control (left) at Studebaker Nursery (4WAT). (Photo by: H. Mathers)

Fig. 20. F6875SC 4X (1.5 lb. /ac) applied on *Hydrangea paniculata* 'Little Lamb' (left) compared to control (right) showing considerable leaf burn, chlorosis, stunting and leaf deformation at all rates at Studebaker Nursery (4 WAT) (Photo by: H. Mathers).

Fig. 21. Biathlon 1X (100 lbs. /ac) applied at *Hemerocallis* 'Stella d'oro' caused chlorosis and necrosis of foliage in leaf whorls possibly associated with the suspension of the granules 4WAT. Damaged lessened after 8 weeks at Studebaker Nursery. (Photo by: H. Mathers).

Table 16. Summary of all herbicides and crops that experienced **no phytotoxicity** at the seven sites in 2012.

Herbicide	**No phytotoxicity**	**Comments**
Indaziflam	*Buxus* 'Green velvet'	
	Rosa 'Knockout'	
	Berberis thunbergii 'Crimson pygmy'	
	Itea 'Little Henry'	
	Viburnum plicatum 'St. Keverne'	
	Viburnum X 'Juddi'	1X only
Biathlon	*Rosa* 'Knockout'	(North Branch and Studebaker)
	Hydrangea macrophylla 'Endless Summer'	1 application only Wash off immediately
	Hydrangea arborescens 'Invincibelle spirit'	
	Azalea viscosum	
	Hemerocallis 'Stella d oro'	OK at Klyn, not at Studebaker's
FreeHand	*Rhododendron* 'Nova Zembla'	
	Azalea 'Karen'	
	Azalea viscosum	
	Hydrangea paniculata 'Unique'	
	Taxus 'Runyon'	Field

	Buxus 'Green Velvet'	Field
Tower	*Hydrangea paniculata* 'Unique'	
	Taxus 'Runyon'	
Tower + pendulum	*Taxus* 'Runyon'	Field
	Buxus 'Green Velvet'	Field
Ronstar	*Rhododendron* 'Nova Zembla'	
	Azalea 'Karen'	
	Weigela 'Rainbow sensation'	
Gallery	*Itea* 'Little Henry'	
	Spirea 'Neon flash'	
	Kalmia 'Olympic fire'	
	Hydrangea paniculata 'Limelight'	
Gallery + Surflan	*Buxus* 'Green Velvet'	
	Berberis thunbergii 'Crimson pygmy'	
Gallery + Barricade	*Azalea* 'Karen'	1X and 2X
	Rhododendron 'Nova Zembla'	Some passing phyto
F6875SC	*Buxus* 'Winter Gem'	
	Thuja nigra	
	Euonymus alatus 'Compacta'	

Beneficiaries.

Beneficiaries from these trials were obviously the nursery managers and staff that were involved in the trials at the seven sites in Ohio. However, in 2012, 16 extension/ research presentations were also given with results from these trails. Seven of these were out-of-state and benefited 504 attendees in MI and IN. Nine were in-state presentations and benefited 2069 attendees from landscape, lawn care, nursery, arboriculture and garden center backgrounds. All of the out-of-state presentations were invited and were for industry organized events. This indicates the value and demand for this information to industry members. All of the in-state presentations were also invited with 65% organized by university, extension or government agencies indicated the high demand for the information from agencies that promote current information to their audiences. One technical report and four contributed articles to technical reports were completed in association with this project. Three papers in proceeding and 9 trade articles were published using information obtained from this project. It is estimated that between the 16 presentations that were given and the 9 trade articles published we reached over 5000 people in the Ohio ornamental industry.

Lessons Learned:

We started the trials very early in the spring to be representative of normal industry preemergence herbicide timing; however, we encountered numerous frost events with somewhat impeded our ability to diagnosis injury at some sites. In the future we will start the trials later in the spring to ensure frost events have past.

Contact Person:

Dr. Hannah Mathers
614-247-6195
mathers.7@osu.edu

Project Title: Increase Grower Awareness an acceptance of GAPS

Project Summary:

The aim of this project was to reach the estimated 2200 small growers who had not yet received training on 'Good Agricultural Practices' (GAPs). Regarding the curriculum, steps were taken to deliver programming that complied with expectations of the Ohio Produce Marketing Agreement (OPMA) and Food Safety Modernization Act (FSMA). The project grant funds helped subsidize an additional 850 farmers. The intent was to incentivize the OSU GAPs training program as it eased growers into the process of complying with regulations under the FSMA. Funds enable the team to develop a resource workbook, 'Risk Assessment & Resource Workbook,' intended to guide growers towards developing their own on-farm food safety plan.

Project Approach:

The first step in the project was to have produce industry stakeholders participate in a focus group session held at The Ohio Agricultural Research and Development Center (OARDC). This was conducted during the first quarter of the project to determine methods to improve and enhance the original GAPs training program. After the focus group session, the program went under construction to fit the suggested needs of the GAPs attendees. While improving the program, the Fruit and Vegetable Safety Team also promoted the training through means such as: Ohio State Extension flyers, VegNet newsletters, the OSU Produce Safety Twitter account (@FruitVegSafety, 477 followers), the Team website (www.producesafety.osu.edu), and press releases from the Ohio State University College of Food, Agricultural, and Environmental Sciences.

The educational program continued to evolve and develop over time in response to stakeholder feedback. Upon completion of the funded project period, the 3-hour course covered 4 integrated topics that impact on-farm food safety: pre-harvest/post-harvest water, biological soil

amendments, good handling practices, and traceability. A team of two extension educators who were also members of the Fruit and Vegetable Safety Team delivered programs. Programs were tailored to the expected audience. For instance we considered how different groups would access and use water for irrigation (i.e.- GAPs associated with an urban farmer utilizing rain barrels for irrigation *versus* Amish growers who primarily irrigate their fields with pond water). In addition, educators incorporated hands-on activities to more effectively reach the audience. For example, GlitterBug® Potion was applied to volunteers' hands and who then washed and subjected their hands to inspection using a black light flashlight to determine how well their hands were cleaned.

Attendees were provided with an up-to-date resource workbook along with a series of handouts that covered the proposed standards in the FSMA produce safety rule. The workbook contained the 4 integrated topics discussed in the training, along with tools to help growers develop an on-farm food safety plan. By having experienced educators facilitate the 3-hour training in a classroom setting, the Fruit and Vegetable Safety Team was better able to accommodate attendees by responding to their concerns efficiently in a face-to-face manner. Once the participants finished the 3-hour course, they received a certificate of completion to keep for their records.

Goals and Outcomes Achieved:

All performance goals and measurable outcomes identified in the approved project proposal were met with the exception of comparing test scores based on participant farm/operation demographics. The obstacle to this outcome was the necessity of maintaining anonymity of farmers on tests per Institutional Review Board (IRB) guidelines.

During the life of the grant, the Fruit and Vegetable Safety Team taught 31 programs to approximately 850 individuals involved in the produce industry. All educational programs are self-supporting through fees charged to attendees and the subsidy provided through this grant. The average cost to present a program was roughly $40 per person and included project development costs, materials, travel, and program delivery. The project funds enabled our Team to subsidize $30 of the $40, which gave stakeholders an incentive to participate in a more affordable program.

Attendees were given the option of completing a pre-test and post-test to determine the effectiveness of the program. With approximately 500 tests submitted, 75% of all submitted test scores showed improvement, 18% of scores stayed the same and 7% scores worsened from pre-test to post-test. While the majority of test scores increased, the Team acknowledges there is room for improvement in program delivery. A testimonial from a southwestern Ohio grower helped give insight from an attendee's perspective:

"Developing a food safety program for our large berry crop and vegetable farm during a time of generational transition was a big worry for me. When I arrived at Local Roots and found myself surrounded by farmers who described their operations as one acre or two, or sometimes one-half

acre I wondered if I had made a big mistake. However, I was in for a surprise. Driving home later that night I knew that I could do this. The program gave me tools and know-how I needed to do food safety on my farm".

Photo: One of the 31 GAPs classes conducted. A "no technology" presentation for the Plain, or Amish community, February 20, 2012.

Photo: Map of Ohio counties indicating locations where GAPs training sessions occurred (purple) and where the Team educators are located (blue). For future presentations, the Team anticipates reaching out more to stakeholders within the red oval.

Beneficiaries:

The 3-hour GAPs course was developed in a manner that attracted a wide array of participants who benefitted from the training. Conventional and organic growers invested in the future of the produce industry wanted to understand on-farm food safety practices and ways to assess the risk of pathogenic contamination at a grower's operation. Farmers with unique production methods such as urban farmers to Amish horse-powered farms, learned new and creative ways to improve food safety while maintaining their way of life. Farmers' market managers and vendors sought methods to implements GAPs at their market to maintain competitiveness. Produce auction

managers and growers wanted to discover ways to improve food safety practices at the auction barn. Ultimately, the buyers who purchased produce from GAPs participants benefitted from consuming products from a farm that understood the importance of reducing the risk of contamination that could cause foodborne illness.

Lessons Learned:

It is increasingly obvious that produce safety awareness is here to stay, and is rapidly evolving on all fronts. As generations continue to be further removed from the farm, consumers are more interested in how the food they eat is raised and are demanding more from their suppliers. In addition to consumer demand, federal regulations are requiring growers to take a proactive approach at reducing the risk of contamination on the farm, rather than reacting to the implications of a foodborne outbreak. Because these pressures exist, there continues to be a need for the Ohio State GAPs training and programs like it.

Through this project the concepts of Good Agricultural Practices and risk assessment have been introduced to and implemented by many growers. Over the life of the project the demand for more in-depth resources with step-by-step instructions and demonstrations on creating farm-specific food safety plan has greatly increased. Farmers have also expressed interest in mock audits and more information on the process of an on-farm third-party audit. To meet these needs, The Ohio State Fruit and Vegetable Safety Team will continue to develop and test relevant curricula once the final FSMA rules are released.

Photo: April 30, 2013 FDA listening session panel members: Joy Johansen, Samir Assar, David Daniels and Michael Taylor

The delayed FSMA draft release hindered the progression of the listening session that was organized to get a better understanding of public concern and needs related to the proposed produce safety rule. After the draft was released, plans to hold the listening session continued

and resulted in a well-attended session with stakeholders voicing concerns related to biological soil amendments of animal origin, agricultural water testing requirements, total on-farm food sales clarification and exempt *versus* non-exempt farms.

Contact Information:

Dr. Doug Doohan
Phone: (330) 202-3593
doohan.1@osu.edu

Additional Information:

Visit our website:

www.producesafety.osu.edu

Photo: Flyer template used to promote GAPs program

Project Title: Online Nursery Stock Locator Search Engine

Project Summary:

The purpose of creating and marketing a web-based Ohio nursery crop buyers guide was to increase knowledge of, access to, and purchase of Ohio's nursery crops. Ohio's nursery industry represented $4.9 billion in Ohio sales, contributed $686 million to Ohio's economy through sales tax (etc.) and $3.15 billion in Ohio payroll in 2008. Anecdotal evidence suggested a decrease in nursery sales, nursery producers, and nursery workers in subsequent years, primarily due to economic conditions and decline in the housing market. Increasing awareness of the variety, quality and type of nursery crops produced in Ohio was critical to the long-term health of Ohio's nursery industry. An increased effort to market nursery crops was required as overall markets improved.

Previously, the Ohio Nursery & Landscape Association (ONLA) printed a survey of growers' plant stock availability, but with rapid change in seasonality as well as demand, the print piece was often out of date by the time buyers received it in the mail. An online resource was

developed to be much more accurate and user friendly. Growers are now able to update their own information and keep it current. Buyers can easily see what each grower has in stock, and reach out to them using the provided contact information and website links.

The ONLA's grower advisory committee proposed the creation of this tool to the ONLA and flagged it as an item of high importance. Further, ONLA noted hundreds of phone calls from buyers around the country to its office upon termination of the printed nursery guide, serving as evidence that an easy Ohio sourcing guide was desired by buyers and the elimination of the guide may have led to missed sales opportunities. Ohio growers have a competitive advantage as very few comprehensive sourcing guides exist in the nursery market and none exist to solely promote and market Ohio producers.

The website is named Nursery Stock Select (www.NurseryStockSelect.com) and went live on October 1, 2012. The ONLA finds this initiative to truly be a win-win for all: it is greener than printing a book, it connects growers and buyers, and it promotes and supports Ohio's economy.

Project Approach:

The ONLA first formed an industry advisory group to research site needs and gather input for site development. Based upon this input, ONLA began designing the site structure, determining what information needed to be displayed, the range of functions available, the relative priority of information and functions, the rules for displaying information, and the effect of different scenarios on the display.

The next step was development of graphics and design elements, including name, logo, and branding. We then began to compile data for the site, import of plant, species, varieties, and cultivars, and then organize this information.

We initiated outreach to growers, solicited participants, distributed information and provided instructions for growers, including the development of a "User Manual". Materials included print and web ads, press releases, trade show displays, fliers, brochures, direct mail post cards; completed media buy for ad placements.

The site was launched October 1, 2012 for growers to enter their product inventories. The initial roll out included an introductory letter to Ohio nursery growers, development and dissemination of a news release to green industry press, and a direct mail post card to Ohio growers.

Goals and Outcomes Achieved:

The program's goal was to develop and implement a year-round marketplace which connects Ohio producers of nursery crops with volume wholesale buyers in order to increase sales of Ohio's largest specialty crop, nursery stock. This direct connection between buyers and growers provided a new marketing method by which Ohio growers can attract and retain clients.
The beneficiaries impacted by this project are Ohio nursery producers (container, field and greenhouse growers).

The primary performance measure in relation to this site is the number of users. Our benchmark goals for the first year of web presence were: engage participation of 100 wholesale growers and obtain 500 registered site users within the first twelve months of site launch. As of October 1, 2013 the site had 92 wholesale growers and 534 registered users participating.

In October 2013, we conducted grower and buyer electronic surveys. We received 25 grower survey responses. 32% responded that they had their plant material listed on NurseryStockSelect.com. 78% of those responding said they were 'satisfied' or 'very satisfied' with their experience with the site. And 75% were 'very likely' to continue using the site.

We received 64 survey responses from industry buyers, including landscape contractors, wholesale buyers, city planners, and landscape architects. 28% of respondents were aware of the website and that it was a free resource, 72% were not. 94% of those respondents using the site have searched for plants by name, 22% have searched for growers by name. 80% of respondents rated the site 'moderate' to 'easy' in terms of locating the information they needed. Only 5% rated the site as 'difficult' to locate information. 7% of respondents contacted a new grower via the website, and 48% of respondents considered the website a valuable resource for their business. 76% of respondents were 'somewhat' to 'very' satisfied with their experience with the website,

While 80% of respondents indicated they were likely to use the site again. We also utilized Google Analytics to measure traffic to the site. As of October 1, 2013 the site had 2005 unique visitors, with 11,269 page views. This averages 4.10 page views per visit. See attached.

A few things that stand out in the reports: the major referral source was from the ONLA website, a popular source for information for Ohio's green industry. But beyond that, the referral leads from press releases to green industry publications, as well as the inquiries drawn from the direct mail post cards and website banner ads, proved worthwhile in driving traffic to NurseryStockSelect.com.

Beneficiaries:

The impact of this wholesale-to-buyer marketplace has been significant in its first complete year and still sees opportunity for even greater effect. Providing buyers with a sourcing guide from a recognized name that they trust also promoted the quality, variety, and marketability of Ohio crops. Growers had immediate access and opportunity to update and promote materials as they became ready to market. Nursery Stock Select was marketed to volume buyers in and around Ohio such as landscape architects, cities and municipalities, retail garden centers, wholesale distribution centers, and landscape contractors. Users were able to look for hard-to-find-crops and locate them in Ohio, and also benefited from the ability to find which wholesale grower closest to them had the plant inventory they were looking for.

While we have been able to track site traffic and referral sources, we have no option but to rely on grower's sales data to track changes in sales volume. Currently growers are not tracking the

source of their leads (website, phone call) and annual sales figures will not be available for a few months. What we can track is that 7% of buyers responding to our survey indicated they have contacted a new grower as a result of their visit to the website. Even a rough projection to the number of registered customers (442) or beyond that to the number of unique site visitors (2,005) would mean an increase in customers for those registered growers, and, we would expect, a boost in sales volume as well.

We will be meeting with the ONLA grower advisory group in early 2014 to review results.

Lessons Learned:

When the Nursery Stock Select site went live, we allowed for a two week testing period with an initial sample of grower data.

We ran into challenges with growers who wished to send in their inventory in one excel spreadsheet as opposed to inputting the data directly to the site on their end. While it seemed that we could provide an easy solution to this and upload for them, each grower had their own inventory tracking system as well as varying plant names so that no two lists were alike. This made for a time delay as well as significant additional labor on the back end for the web design team.

While this complete marketing tool has been made available to Ohio growers at no cost to them, the one hurdle they must clear is the uploading of their inventory to the site. We have worked to make this as easy and seamless as possible, but each grower's unique system has made this more complex. In looking ahead, we plan to interview growers and look for a way to make this upload less time consuming, and get more Ohio growers to participate. One thing we've considered is a standardized list of plant names and product codes as a 'code column' inserted into each grower's plant inventory. This would make for a much simpler, faster upload procedure than receiving a unique naming and coding system from each participating grower.

Beyond that, we've discovered the need to continue marketing in the years ahead. Now that the site is running and drawing visitors, we need to continue to build on this early momentum. The project's stated goals were for one year benchmarks. We continue to see the need in the marketplace that this website fills, and the immediate ability to connect buyers with Ohio growers in their search for plant stock. The ONLA team will review how we market this website to continue its growth and ability to increase the sale of Ohio nursery stock.

Contact Information:

Kevin Thompson
614-899-1195
kevinthompson@onla.org

Project Title: Central Processing Facility

Project Summary:

The following information describes the results of the project coordinated by CIFT to review the facility requirements and operational needs for a centralized processing facility that would expand local produce into institutional markets. A comprehensive evaluation incorporated input from growers, information from buying outlets, and applied engineering services to address the physical characteristics of a facility.

In the course of interacting with more than forty member companies and organizations and with several hundred other agribusinesses, CIFT became aware of an increasing interest among growers in producing specialty crops for markets within Ohio to capitalize on expanding demand for local products. A barrier to acting on this interest is a lack of infrastructure. The goal of this project was to produce a plan for the establishment of a central processing and distribution facility that is of sufficient size to be economically viable. Included in the plan are the plant design, required investment, interested customers, as well as anticipated needs for sufficient supply to the facility. The plan touches on opportunities for season extension to maximize the opportunity.

Project Approach:

Specialty crop production, particularly for retail markets, has declined in much of Ohio, both in terms of output and number of participants. First of all, the long term erosion in specialty crop production has led to an elimination of much of the infrastructure required to produce these crops in an economical manner. A significant trend among consumers is a desire for locally grown produce. The lack of processing infrastructure limits the levels in which specialty producers can participate beyond farmer's markets and a limited number of small retail establishments. A number of growers expressed interest in retail sale for a portion of their output as a hedge against the risks inherent with producing for single customers. This project provides a blueprint for establishing a processing plant that is of adequate size to form the basis for a profitable operation that will allow growers to capitalize on the consumer demand for local produce. Once the infrastructure defined by this project is in place, commitments to specialty crop production will become easier for growers.

Goals and Outcomes Achieved:

An initial deliverable for this project is an evaluation of the economic feasibility of a processing facility for a variety of specialty crops. Depending on the business model determined, engagement of industry and growers would be pursued. Several challenges were identified throughout the process and will need to be further investigated prior to implementation but a baseline has been created.

The results of the work were presented to several audiences as a mechanism for outreach. First, information was shared with the CIFT Board of Directors comprised of industry executives with extensive experience in produce and processing including Hirzel Canning Company, Sandridge Foods, GreenLine Foods, Smuckers, and Kraft. One particular member established a company specifically to process and package fresh green beans. He shared insights on the work as well as shared information with the growers within his network of suppliers. Secondly, information was incorporated into a meeting hosted to inform more than 48 growers of research and demonstration efforts conducted that could positively impact their operations. The results of this project coupled with the established freezing operation managed by CIFT showcased the potential for a centralized processing establishment and the benefits. Details will be available at the Ohio Produce Growers Marketing Association trade show wherein more than 80 growers can be informed. Equally, CIFT has been asked to participate in an Ohio State University Extension Berry School in which information will be presented to berry and additional specialty crop growers considering engaging in production or establishing a central processing location. A reference to this work was distributed to more than 180 growers through electronic communication and provided a method of obtaining further information. Finally, regional economic development representatives have been informed of the project in the event a business considers a similar concept and the information can be shared.

Activities associated with each component of the project are highlighted below to further demonstrate the outcomes achieved.

1. A business plan was created to define the methodology for a centralized location, the market opportunities associated, operational requirements ranging from equipment to staffing, and financial projections.
2. Crops were selected for inclusion based on local production, ease for growers, market appeal, and desirability within the marketplace.
3. Growers were surveyed at various events and through direct interaction to explore interest in expanding production of specialty crops to supply this facility. Insights into issues such as labor and transportation of product were documented.
4. Interviews with retailers, institutional buyers, and large procurement contacts defined the products, packaging, and price needs associated with such an operation.
5. An engineering firm created the design and facility requirements for a new build. This included all the equipment, cooling, drainage, transportation, and holding details in order to manage according to all applicable food safety guidelines.
6. A secondary option is to identify existing outlets with potential for upgrades rather than a new build approach. A few locations were identified with various positive attributes.
7. While identifying the crops for initial focus, rough estimates on quantity was calculated as a means for growers to anticipate if additional acreage would be required.
8. Marketing insights were incorporated into the business plan document for consideration. These are certainly not comprehensive and can be modified by the managing entity operating the facility and designed according to buyer requirements.
9. The financial projections are based on crops anticipated but will adjust as new are introduced or buyers are engaged more directly. There is a favorable job creation

component to this type of business but limitations in terms of available produce and seasonal restrictions.

Beneficiaries:
The targeted audience, as defined by this project, was specialty crop growers of substantial enough size to consider increased production or diversification of sales to institutions, retailers, or wholesalers. The increased interest in local foods coupled with the limited infrastructure to accommodate large amounts of product was the drivers to conduct this evaluation. Ultimately, the beneficiaries are growers who may gain increased sales penetration, buyers searching for minimally processed product, and consumers desiring increased access to local foods. If a location is pursued, then jobs and local economic impact will result which benefits the entire industry.

Lessons Learned:
One of the more enlightening lessons learned, that wasn't entirely anticipated, is the growers interest in such a facility. It seemed as though this type of outlet would be well received and anxiously awaited. However, many growers are content with the current production capacity and identified markets and not searching for new channels for expansion, in which this would enable. There are those who welcome inclusion into such an effort, however, many of the medium operators are not as willing to increase size due to labor challenges. In addition, most are continuing to integrate the necessary food safety requirements and expanding to these markets would increase the efforts. The larger growers would be tapped first to supply this operation and will likely demonstrate the opportunities to other growers for increased appeal. Equally, although a new facility would be exciting and generate enthusiasm around the effort, the cost far exceeds the business model. Retrofitting an existing location to meet the facility requirements would likely be a more practical approach. Finally, the benefit to such an outlet is the increased potential for local produce direct to consumers. However, in order for the business to operate, the seasonal component would be addressed by sourcing nationally and potentially internationally in the off-season. This in turn defeats the vision and minimizes the market appeal.

Contact Person:
Dave Beck
President, CIFT
dbeck@ciftinnovation.org

Alan Bernard
Project Manager
abernard@ciftinnovation.org

Additional Information:

As the interaction increased with individual operations and buyers, new insights were considered. The format of information has taken multiple variations in order to communicate findings. A business plan document defines the marketing and operational components while a PowerPoint highlights the equipment, staffing, and overall vision. The second option will be useful in making presentations to growers and industry leaders as to the findings of the project. The virtual tour of a potential facility is expected to generate excitement and solidify the concept to growers.

Project Title: What's Growing in Your Neighborhood? Healthy Produce. Healthy People. Healthy Connections.

Project Summary:

The original intent of this project is to improve the Ohio specialty crop (OSC) industry by capitalizing on the economic purchasing power of urban communities through marketing, collaborative outreach, and a web-based database for connecting producers and farmers' markets.

Summary of tangible accomplishments.

- Expanded on previous grant's success by adding an 8th (Gateway 105), and later 9th market (Wade Oval Wednesdays/WOW), continuing the branded look and feel of our collateral promotional pieces.
- Secured partnership with Clear Channel to provide $4,515 of billboard in-kind advertising space.
- Updated previous grant marketing pieces (to educate consumers on the health and local economic benefits of OSCs and shopping for them at Cleveland Farmers Market Guide (CFMG) farmers' markets) that were very popular: *farmers' market shopping guide for OSCs ("farmers' market pocket guide"), what's in season guide* and growhio.org grant page with google map of participating markets. Also, created a new piece, a map display piece for holding pocket guides and engaging audiences at outreach events.
- Capitalized on partnerships with Sustainable Cleveland 2019 (SC2019) and EcoTuesday to"kick-off" our project to our ideal audience (for receipt of outside promotion) via the E4S local Food 3rd Tuesday event and EcoTuesday February Meet-Up. This strategy saved significant expenses and resources while achieving our objective of featuring our project to supports and press who could help us spread the word.
- Executed outreach at the Earth Day Expo, Urban Ag Symposium, Earth Fest at the Zoo, Fabulous Food Show, Burning River Fest, 2 Cleveland Public Library Summer Reading Series Kick-off events at Rockport and Woodland branches, Potluck in the Park and Food for Thought at Ingenuity Fest.
- Executed a Farmers' Market Cash Mob Week to intensely promote all participating markets in a concentrated time period.

- Developed a web-based market-OSC vendor connector database to streamline the vendor application process so that specialty crop producers (new and old) will be able to more quickly and easily apply to vend at one or multiple participating markets. The database helps save time and resources of market managers so that they can expend more effort on consumer outreach related to specialty crops.

By the numbers:

- Attended 11 local events to conduct outreach/promote OSCs at farmers' markets.
- Distributed 3,000 *farmers market pocket guides* to community members.
- Distributed 3,000 *what's in season guides* to community members.
- Advertised with 7 billboards, multiple e-newsletters and on facebook and twitter.
- Surveyed 183 market attendees through OSC surveys.

Project Approach:

Growhio held monthly meetings throughout the grant cycle for representatives of Growhio and each participating market to approve deliverables/strategies, divvy up tasks, and discuss, evaluate and identify ways to improve project progress. Growhio also maintained a google website (non-public) for all grant participants for storing/sharing project documents, communicating meeting minutes and tracking budget expenses and project goal/outcome progress. Once project activities began winding down, Growhio and the markets began organizing data for website traffic, EBT sales, market sales, and survey results into a google spreadsheet. At the conclusion of our activities, we discussed our data, performance, takeaways/lessons learned and ideas generated from this evaluation to build on for the following year (outside of the grant cycle). These discussions served as the basis for the development of our Statewide Outreach report.

1) Execute marketing including billboard and other advertising to promote the availability of OSCs at the 8 participating farmers' markets, which include the Specialty Crop Blog Grant 2010 (SCBG10) markets (Broadway, Coit Road, Downtown Cleveland, Gordon Square, Kamm's Corners, Lakewood and Tremont) plus Gateway 105.

- **1st Quarter:** In pursuit of our 1st goal to execute a marketing/outreach campaign that encourages more people to shop at their local farmers' market for OSCs, we developed a plan for joint advertising by all markets.
- **2nd Quarter:** During the 2nd quarter, we continued to convene regular meetings, maintain our internal website/intranet and growhio.org grant page. We also added a 9th market (Wade Oval) to our project to increase exposure and impact. During this quarter we also began scheduling billboards and monitoring growhio.org traffic.
- **3rd Quarter:** During the 3rd quarter, we continued to convene regular meetings, maintain our internal website/intranet and growhio.org grant page. We began billboard advertising for 6 billboards/markets. We also wrote a news piece that resulted in press on Coolcleveland.com. And, we continued monitoring growhio.org traffic for goal 1 benchmark 2.

- **4th Quarter:** During the 4th quarter, we continued our regular meetings, maintained our intranet and growhio.org grant pages. Billboard advertising began for our 7th billboard/market (Lakewood). We also continued monitoring growhio.org traffic for goal 1 benchmark 2.
- **5th Quarter:** During the 5th quarter, we wrapped up our activities in this area.

2) Execute collaborative outreach program, including tools such as a pocket guide to OSCs at farmers markets, to educate consumers on the health and local economic benefits of OSCs and shopping for them at CFMG farmers' markets.

- **1st Quarter:** We created a list of target events for outreach, informed in part by The Ohio State University Extension - Cuyahoga County (OSDU) and the Cleveland-Cuyahoga County Food Policy Coalition (CCCFPC), including the Spring Fabulous Food Show and Burning River Fest. We developed market survey for attendees to gauge marketing campaign impact, updated our *what's in season guide* and created a copy in Spanish language. We also created mock-ups of a joint display piece and kicked off our outreach with a table at the city of Cleveland's Year of Local Food event.
- **2nd Quarter:** We finalized promotional handouts (*what's in season guide* and *farmers market pocket guide*) and ordered printing. We hired a designer to create a map for a joint display piece. We continued our outreach efforts, but in lieu of creating our own kick-off event, we capitalized on partnerships with Sustainable Cleveland 2019 (SC2019) and others to "kick-off" our grant project at the E4S Local Food Cleveland 3rd Tuesday event on 2/21 and an EcoTuesday meet-up on 2/28. These events were targeted at our ideal audience and received significant outside promotion in addition to promotion by OSUE and CCCFPC. By utilizing these events to "kick-off" our project, we saved significant expense and resources, while achieving our objective of featuring our project to supporters and press who could help us spread the word. We also did outreach at 3 additional events: Earth Day Expo, Urban Ag Symposium and Earth Fest at the Zoo.
- **3rd Quarter:** We updated our promotional handouts again and reordered printing. We began surveying for goal 1 benchmark 1. We continued outreach at 5 events: Fabulous Food Show, Burning River Fest and 2 Cleveland Public Library Summer Reading Series Kick-off events at Rockport and Woodland branches.
- **4th Quarter:** Markets completed 183 surveys for goal 1 benchmark 1. We continued and completed our outreach via 3 events: Farmers' Market Cash Mob Week, Potluck in the Park and Food for Thought at Ingenuity Fest.
- **5th Quarter:** We wrapped up our activities in this area.

3) Develop a web-based database for connecting producers and farmers' markets

- **1st Quarter:** In pursuit of our goal to increase the supply of OSCs in urban communities by facilitating information sharing between OSC producers and farmers' markets with a database system, we began by conducting extensive research on best practices and comparable tools. We drafted a framework for the

database and a vendor application template. We also met with potential database developers and a number of potential strategic partners.

- **2nd Quarter:** We met with our database developer 3 times to sketch out desired elements, work through our functionality wish list and develop a mocked-up look and feel.
- **3rd Quarter:** We had 3 meetings with our database developer, during which we worked on populating growhio.org into a new site content management framework, within which the database will integrate. The structure for the database was also created.
- **4th Quarter:** We had 3 conference calls with our database developer. We finished populating Growhio.org into a new site content management framework, within which the database will integrate. The framework for a markets page and market profile pages in the database were created. We held a demo training session for market managers to walk through the database system and solicit feedback. Developer began process of finalizing a vendors page and vendor profile pages, as well as the application process functionality before we roll out to vendors.
- **5th Quarter:** The framework for a vendors page and vendor profile pages in the database were created. We created a recorded training video for vendors to walk through the system. We piloted the system with OSC vendors and solicited their feedback via a survey.

Post-grant, our statewide replication document will be distributed to OSUE, CCCFPC and NEO Food Web for further distribution and sharing of best practices.

Goals and Outcomes Achieved:

Evaluation of project benefits to specialty crop industry.

1) Execute a marketing/outreach campaign that encourages more people to shop at their local farmers' market for OSCs.

- **Performance Measure 1** - At least 5 times during the season, market managers will perform surveys of market attendees. One of the items will measure how new and established attendees learned about the market. A better understanding of the number of new participants that were participating in the market is a key ingredient in measuring the effectiveness of the marketing campaign. The following benchmarks will be measured.

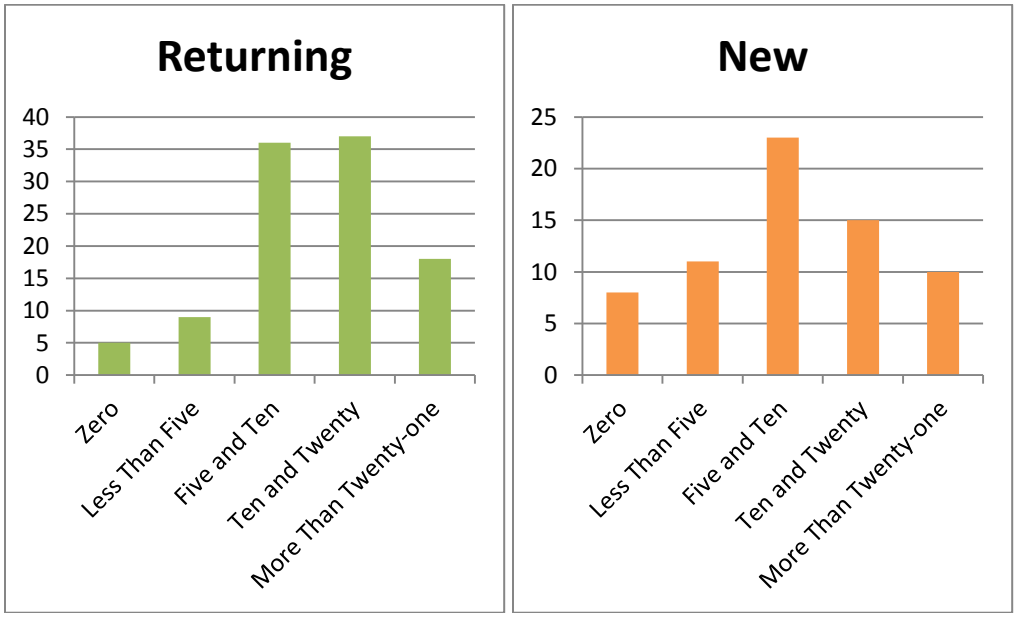
  Benchmark/Target 1a – 10% of new attendees that are surveyed each will indicate that they were persuaded to attend the farmers' market to shop for produce through Growhio's marketing campaign and/or outreach program (which will showcase the specialty crop industry with pictures) over the course of the market season. Surveying the established attendees and how they initially found out about the market and why they shop will provide a general understanding for market demand.

Results: A total of 183 market attendees were surveyed. Of 67 new attendees surveyed about a third (33%) indicated it was elements of Growhio's marketing and outreach that persuaded them to attend the market. Of 116 returning customers surveyed half (50%) indicated it was elements of Growhio's marketing and outreach that originally or continues to bring them to the market. Other reported factors contributing to market attendance are word of mouth or visiting another market.

Benchmark/Target 1b – The new attendees that are surveyed will indicate the type of product they purchased and why they were persuaded to go to the farmers market (which will showcase the specialty crop industry with pictures) over the course of the market season. These two survey groups will be compared with each other to better understand the effectiveness of the marketing campaign

Results: Of 105 returning attendees, 87% purchased produce at the market during their visit. Of 67 new attendees, 75% purchased produce at the market during their visit. Other results include:

About how much did you spend on produce today?
Returning Attendees: Of 105 surveyed, 5% spent no money, 9% spent less than $5, 34% spent between $5 and $10, 35% spent between $10 and $20, and 17% spent more than $20. Assigning the mean value to each response it is estimated that the combined expenditure on produce from returning attendees was about $1,297.50.

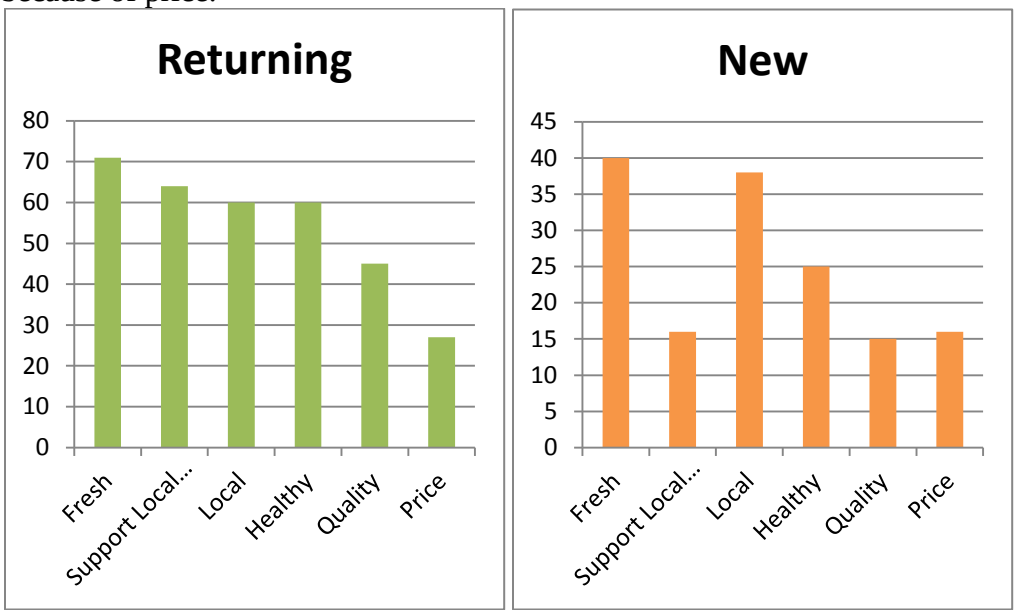


New Attendees: Of 67 surveyed, 12% spent no money, 16% spent less than $5, 34% spent between $5 and $10, 22% spent between $10 and $20, and 15% spent

more than $20. Assigning the mean value to each response it is estimated that the combined expenditure on produce from new attendees was about $675.

Takeways: Combined estimated expenditure on produce for the 172 shoppers surveyed was $1,972.50 or $11.50 per person. Spending above $10 is a significant amount of produce for a couple or a family.

Why did you choose to shop for produce at this market today?
Returning Attendees: Of 105 surveyed, 71 respondents indicated it was because of freshness, 64 because they wanted to support local businesses/farmers, 60 because it was local, 60 because it was healthy, 45 because of quality, and 27 because of price.



New Attendees: Of 62 surveyed, 40 respondents indicated it was because of freshness, 16 to support local businesses/farmers, 38 because it was local, 25 because it was healthy, 15 because of quality, and 16 because of price.

Takeaways: Due to the high numbers of respondents reporting fresh, local, healthy, we believe our messaging (including our healthy produce, healthy people, healthy connections tagline) has been successful in promoting the freshness quality, and healthfulness of OSCs. Returning attendees also took home our messaging on local economic benefits of OSCs. Perhaps more can be done to message about OSCs' value for price.

If you did not purchase any produce today, why not?
Returning Attendees: Less than 6% of returning attendees did not purchase produce. Of the 6 people who did not purchase produce, reasons included that they couldn't find what they wanted (1), quality (1), no time to prepare it (1), they already receive produce through a CSA (1) or grow their own produce (2).

New Attendees: 13% of new attendees did not purchase produce. Of the 8 people who did not purchase produce, reasons included that they couldn't find what they wanted (3), do not like produce (1), no time to prepare it (2), they already receive produce through a CSA (1) or grow their own produce (1).

Takeaways: Most of those surveyed, new as well as existing customers, purchased produce and value the produce available at market - which indicates that our marketing and outreach was very successful. Out of the 14 people indicating they did not buy produce, almost a third indicated it was because the already had access to produce through a CSA or by growing their own. The rest indicated that they either do not like produce, could not find what they wanted or had no time to prepare fresh produce. The markets will be looking at ways to convert the no purchase rate into purchases such as by broader distribution of the *what's in season guide* and targeted chef demons and cooking classes with more enticing tastings.

How likely are you to return to this market and purchase produce?
Returning Attendees: Of 105 surveyed nearly all indicated they were likely to return, except 2 who were neutral. 26 said they were likely and 77 indicated they were very likely to return to purchase produce.

New Attendees: Of 67 surveyed nearly everyone indicated they were likely to return, except 1 who was neutral. 5 were somewhat likely, 21 were likely and 40 indicated they were very likely to return to purchase produce.

Takeaways: The vast majority of attendees, new and existing indicated they would return to purchase produce, which suggests that when a marketing campaign is successful in encouraging attendees to visit one of our markets to shop for produce, the produce shopping experience is positive for the shopper and not only results in the majority of shoppers purchasing about $11.50 worth of OSCs on average, but also planning to return to purchase OSCs in the future.

- **Performance Measure 2** - Growhio's website traffic will be monitored through google analytics to track the traffic over the course of the grant period.

  Benchmark/Target 2 – Growhio will monitor the website before and after the marketing campaigns to see if there are significant differences for customers visiting their website.

  Results:

Time Frame	Website Unique Visitors (% new)	Grant Page Unique Visits	Comments

1/23-2/6	159 (71%)	17	
2/7-2/21	223 (71%)	36	Kick-off 1 occurred in time period
2/22-3/7	217 (69%)	24	Kick-off 2 occurred in time period
3/8-3/22	281 (65%)	15	
3/23-4/6	270 (64%)	60	Promoted event for 4/29
4/7-4/24	460 (70%)	95	3 events occurred in time period
4/25-5/8	254 (65%)	58	2-day event occurred in time period
5/9-5/22	245 (66%)	34	
5/23-6/5	366 (73%)	43	1 event occurred in time period
6/6-6/19	461 (76%)	43	1 event occurred in time period
6/20-7/3	360 (75%)	29	
7/4-7/17	243 (73%)	27	
7/18-7/24	133 (72%)	15	1 event occurred in time period
7/25-8/7	292 (73%)	41	
8/8-8/21	343 (74%)	34	Part of cash mob market week
8/22-9/4	214 (64%)	16	Part of cash mob market week
9/5-9/18	186 (80%)	6	1 event occurred in time period
9/19-10/2	239 (73%)	3	1 event occurred in time period
10/3-10/16	116 (70%)	4	
10/17-10/24	37 (56%)	0	
TOTALS	**5,099 (70%)**	**600**	

Overall, we tended to have higher traffic, particularly to the grant page during time periods of outreach events, as opposed to time periods with no outreach events. We believe that because of our continuous promotional efforts throughout the season via billboard advertising and social media, it is not possible to gauge the impact of particular events on website traffic. However, it is clear that traffic was heaviest during our highest output of promotion - April through September, and heavier than before our outreach efforts began.

- **Performance Measure 3** - Each farmers' market with EBT capabilities will track EBT sales on a monthly basis and compare with the previous year's sales for each month.

  Benchmark/Target 3 – Each farmers' market with EBT capabilities will achieve a 15% increase in EBT sales from the previous year.

  Results: EBT sales increased 343**%** from the previous year for all markets.
  - 1,515.33% increase – Lakewood Farmers' Market
  - 1,011.50% increase – Gateway 105 Farmers' Market
  - 90.07% increase – Kamm's Corners Farmers' Market
  - 79.6% increase – Coit Road Farmers' Market
  - 27.7% increase – Downtown Farmers' Market
  - 22.59% increase – Tremont Farmers' Market
  - 10.36% increase – Gordon Square Farmers' Market
  - 13.16% decrease – Broadway Farmers' Market

  Although there were 2 markets that did not hit the 15% increase goal, all 6 of the other markets overwhelmingly exceeded it. For Broadway, although EBT sales decreased, overall market sales nearly doubled, and so we feel the market was successful in attracting and generating more OSC sales. For Gordon Square, overall market sales were down, and we attribute this and the less than 15% increase in EBT sales to the market's multiple transitions in leadership and structure from the previous season and during the most recent season. Lakewood and Gateway 105 did not have EBT in 2010. Generally, the first year of EBT availability, sales are very low because the word has not yet spread about its availability. It is not uncommon to see a large jump in EBT sales between the first and second year and we recognize that this can make figures appear skewed. Excluding these two markets still results in an EBT sales increase of 36.19%, well above our 15% target.

- **Performance Measure 4** - Each farmers' market will track market sales for the season and compare with the previous year's sales to gauge growth.

  Benchmark/Target 4 – Each farmers' market will achieve a 5% increase in overall sales from the previous year.

  Results: Market sales increased 288**%** from the previous year for all markets.

- 412.89% increase – Gateway 105 Farmers' Market
- 85.56% increase – Broadway Farmers' Market
- 54.07% increase – Downtown Farmers' Market
- 53.85% increase – Lakewood Farmers' Market
- 34.29% increase – Kamm's Corners Farmers' Market
- 23.59% increase – Tremont Farmers' Market
- 4.0% increase – Coit Road Farmers' Market
- 18.37% decrease – Gordon Square Farmers' Market

Although there were 2 markets that did not hit the 5% increase goal, all 6 of the other markets overwhelmingly exceeded it. For Coit Road, although market sales just missed the targeted 5% increase by 1%, EBT sales were significantly higher, and so we feel the market was successful in its outreach and marketing efforts. Coit will be considering ways to attract additional non-EBT customers and to continue to increase the purchases and purchase frequency of EBT customers. For Gordon Square, overall market sales were down, and we attribute this and the less than 15% increase in EBT sales to the market's multiple transitions in leadership and structure from the previous season and during the most recent season.

2) Increase the supply of OSCs in urban communities by facilitating information sharing between OSC producers and farmers' markets with a database system.

- **Performance Measure 1** - Growhio will track the number of specialty crop vendors registering in the producer database on a monthly basis.

  Benchmark/Target 1a – 25 OSC vendors will register their information. It is hoped that over the course of the summer that an additional 10 percent of the specialty crop producers will register their information/business in the database.

  Results: 35 vendors have their information/business registered in the database. Of those vendors, 11 have also tested the application feature of the database by "test" applying for one or multiple participating markets (for the pilot, vendors were asked to pretend apply as if they were applying for Spring 2013 season).

  Benchmark/Target 1b – We are also going to monitor qualitative feedback from those that participated on the database to examine their farmers' market experience.

  Results: 2 veteran vendors (who collectively vended at 4 participating markets) provided feedback via a survey. One vendor indicated the database was excellent in terms of ease of use and the other vendor indicated it was good. The vendors also inicated that the database was excellent in terms information organization, process for profile completion, ability to shop/review profiles of participating markets, process for applying to a single or multiple markets, auto-response confirmation emails and overall experience. The vendors both preferred the

database to a traditional paper application. With respect to overall market experience, the vendors rated market management, interaction with other vendors and overall experience excellent. One vendor also rated customer volume and market sales excellent and the other rated these areas as good. One vendor also provided commentary, noting that the market season was insightful and rewarding.

3 first time vendors also provided feedback via a survey. The database received ranks of good or excellent by all respondents in the areas of ease of use, information organization, ability to shop/review profiles of participating markets, and process for applying to a single or multiple markets. Areas for improvement included process for completing the vendor profile and auto-response confirmation emails. Two out of 3 of the vendors preferred the database to a traditional paper application. With respect to overall market experience, all rated market management and interaction with other vendors good or excellent. One each rated customer volume at average, good and excellent. One rated overall experience at average and the other two rated it good. One vendor indicated that they were still trying to figure out what sells and how to sell more product to each customer. Another indicated that the vendor "had a great experience with the management and other vendors." All vendors planned to return to vend at the market next season.

We wish that we were able to get more responses. In the future, we feel an incentive would be a good way to encourage greater participating by offering, for example, a waiver of a market application fee, for participating in the database pilot and completion of the survey. The responses received do show that the markets are doing a good job overall for their vendors. We feel that the best way to continue to improve is for the markets to continue sharing experiences and best practices with each other so that the markets can learn lessons from each other and generate ideas for enhanced performance and services.

Beneficiaries:

Beneficiaries of our project included the 9 markets and 35 specialty crop producers who received the benefit of our database development and pilot for a streamlined web-based application process. These beneficiaries also realized increased sales as a result of our marketing and outreach efforts to attract more consumers to the markets for OSCs. Beneficiaries also included the more than 2.35 million consumers who were exposed to the availability of OSCs at the markets via billboard advertising; the more than 3,000 consumers who were introduced to OSCs, their benefits or where to find them through receipt of our *farmers market pocket guides* and/or *what's in season guides* at 11 local events; and consumers who were exposed to our press on CoolCleveland.com.

Lessons Learned:

Our marketing campaign, which was intended to reach 2.6 million residents of Cuyahoga County, has gained an exposure of 2.35 million people (we would have reached 2.6, but 1 market was unable to secure billboard space in its neighborhood during the market season, so we had 7 and not 8 billboards). This means that 2.35 million people, through an online news piece, *what's in season guide*, *farmers market pocket guide*, billboard, facebook, twitter, or interaction with us at one of 11 local events, have been exposed to our message promoting OSCs at area farmers' markets. Before our first 2010 ODA grant, 7 markets had combined sales of around $407,810. At the conclusion of that grant cycle, the markets had increased sales by more than $43,000. At the conclusion of our current grant cycle, those same 7 markets have increased sales by an additional more than $148,000, for a total increase of $191,000 over the two grant cycles. Our 8th market has also contributed its sales of $7,283. These increases show the power of reinforcing our message over time... more and more people have begun to make the connection between OSCs and healthy produce, healthy people and healthy connections - available at their local farmers' market; and, they are buying more OSCs at the market. Our surveys show that about a third of the impacting factors in persuading a new attendee (v. almost half for returning attendees) to visit a market were from our marketing and outreach efforts, with the remaining factors being word of mouth or visiting another market. This indicates a positive connection between our project efforts and increased sales at the markets. We believe we were on track to continue using the look/feel of our previous year's marketing materials, to conduct outreach via local events, and to promote via our *what's in season guide* and *farmers market pocket guide*. Our map display piece built on the growhio.org map concept utilized in our 2010 grant period, and was also well-received by consumers at local events.

By far the most challenging aspects of this project were in trying to achieve consistency in engagement/participation/actions of the markets and completion of the web-based market-vendor connector database. It was and will always be difficult to manage scheduling and collaborative activities among 8 independently operated and managed markets. If all of the market managers were employed by the same entity, or indeed, employed full time as market managers, many grant activities and meetings could take place during 9-5 hours. However, many of the managers are volunteer (and Growhio staff is also volunteer) and we maintain full time jobs outside our market/Growhio efforts. You can't buy or grow time. We've learned that we will never be able to get all markets to participate equally, and the best way to achieve our goals is to record participation hours and reward personnel funds based on the levels of participation; as well as to make receipt of personnel funds contingent on completion of certain minimal grant activities or requirements.

Development of the database took much longer than expected. We've learned that one way to make this a faster process would be to look for a developer with an off-the-shelf system that could be adapted to this project. However, the advantage of going with a custom system is that our developer was able to design it to fit within our website and customize it to fit the needs of our participating markets. And although our developer is a one-man show that did not complete the project as quickly as hoped, he is extremely responsive to inquiries and provides invaluable one-on-one support to market managers and vendors with respect to the system. In retrospect, we believe we took the best route in choosing this developer to fit our needs for the project and if starting all over, would have adjusted only our anticipated timeline - not the process.

Contact Person:

Gwen Forté,
gforte@growhio.org
216.264.6975

Additional Information:

Description of information/educational materials developed.

Images/copies of these materials are provided in the attached PowerPoint (Attachment A):

- What's Growing? joint display map sign
- *What's in season guide*
- *Farmers market pocket guide*
- Growhio newsletter articles
- CoolCleveland article
- Billboard ads
- Cash mob facebook cover photos
- Cash mob poster and promotional image
- Market visitor survey
- Vendor database, instructions and training video
- Vendor survey
- ODA grant webpage on growhio.org
- Project intranet google site

Project Title: Appalachian Producers—Marketing & Branding Project

---

Project Summary:

ACEnet in collaboration with training and market partners provided training, technical assistance and access to a licensed food enterprise incubator to specialty crop producers to increase wholesale market access and annual sales/profitability for fresh and processed specialty crops via targeted market channels: restaurants, grocery retailers and educational institutions. Three objectives were employed: 1) Training win collaboration with partners on Market Ready, GAP and HACCP training, 2) 30 Mile Meal Regional brand promotions, and 3) Improved processing and packaging for fruit and vegetable farmers creating value-added products.

Project Approach:

The project budget and match only funded fruit and vegetable farmers utilizing the Food Ventures Center to create bottled, frozen or dehydrated product lines. The GAP, Season Extension, Buyers and Sellers forums were only open to specialty crop producers interested in

accessing restaurant, wholesale grocery and institutional buyers. The training and workshop delivery for the project has been implemented by ACEnet staff and ACEnet agricultural partners. Our primary training partners included Dr. Julie Fox of the OSU Direct Marketing Team, Tom Redfern, Sustainable Agriculture Director of Rural Action and Hal Kneen, GAP trainer and Athens/Meigs County Extension. We also provided training to specialty crop farmers selling direct at farmers market. ACEnet's role has been to either host and facilitate or partner with other trainers as a presenter. The following chart list the types of trainings, the date, the number of specialty crop attendees the training partners and the locations. Some of the site locations were held outside the eight counties in the project target but were attended by specialty crop growers from Appalachia Ohio counties. Training chart attached as pdf.

The graphic design work for promoting fruit and vegetable sales to the restaurant buyers and grocery buyers only had graphic design and photo content of specialty crop producers. See pdf documents for diagrams and signage examples.

Training, Workshops & Peer Learning Events

Essentially all the training and workshop delivery for the project has been implemented with various ACEnet partners. Our primary training partners included Dr. Julie Fox of the OSU Direct Marketing Team, Tom Redfern, Sustainable Agriculture Director of Rural Action and Hal Kneen, GAP trainer and Athens/Meigs County Extension. ACEnet's role has been to either host and facilitate or partner with other trainers as a presenter. The following chart list the types of trainings, the date, the number of specialty crop attendees (not the total attendees in some cases,) the training partners and the locations. Some of the site locations were held outside the eight counties in the project target but were attended by specialty crop growers from Appalachia Ohio counties.

Date	Type of Training	SC or Buyer attendees	Partners	Location
1/9/12	FWL & 30 Mile Meal Branding	11	30 Mile Meal	Athens
1/30/12	Country Fresh Stops – Buyers/Framers	12	Rural Action	Athens
2/1/12	Brand Programs	7	South Center	Piketon
2/3/12	GAP Certification	17	Rural Action	Morgan
2/19/12	30 Mile Meal Branding	24	OEFFA	Granville
3/5/12	GAP – High Tunnel	35	Rural Action	Morgan
3/7/12	Farm to Table Buyers	9	Rural Action	Nelsonville
4/1/12	Brand Programs	19	30 Mile Meal	Athens
4/12/12	GAP Certification	17	Rural Action	Morgan
4/16/12	Brand Programs	8	SPICE	Shawnee/Perry
4/20/12	Brand Programs	10	Coop Food Network	Akron

5/3/12	Brand Programs	5	Buckeye Hills	Washington
6/11/12	30 Mile Meal Branding	7	Lake to River Coop	Youngstown
6/12/12	Market Ready Wholesale	24	Market Ready Team	Canfield
6/15/12	Market Ready Into	13	Market Ready Team	Athens
6/21/12	Market Ready Into	6	Market Ready Team	Athens
7/11/12	30 Mile Meal Branding	12	Real Food Institute	Athens
7/11/12	Institutional Buying	11	Real Food Institute	Athens
7/11/12	Building Farm to Table Sales	22	Real Food Institute	Athens
7/12/12	Season Creation for Profitability	17	Real Food Institute	Athens
8/14/12	30 Mile Meal Brand Program	6	RCAP	Columbus
9/10/12	30 Mile Meal Brand webinar	7	30 Mile Meal Project	4 counties
10/3/12	Processing & GMP (facility tour)	42	ACEnet – Food Ventures	Athens
11/24/12	Farm to Table	16 farmers & 9 buyers	Rural Action	Vinton
12/6/12	Season Extension & GAP Issues	35 registered	Rural Action & Green Edge	Amesville
Jan. 9	Branding -- 30 Mile Meal Training	8	Real Food Institute	Granville
Jan. 9	Branding -- 30 Mile Meal Training	21	Real Food Institute	Newark
Feb. 28	Branding -- 30 Mile Meal Training	8	Real Food Institute	Warren
Mar. 12	Farmers Market Vendor Workshop	21	Ohio FMMN	Columbus
Mar. 26	Market Ready Training	42	Market Ready Team	Cleveland
Apr. 13	Farmers Market Vendor Workshop	11	Market Ready Team	Somerset
Apr. 22	Market Ready Training	11	Market Ready Team	Chesterhill
Apr. 23	Market Ready --- Buyer & Sellers	14 farmers & 12 buyers	Market Ready Team	Granville
Apr. 25	Farmers Market Vendor Workshop	5	Nelsonville Farmers Market	Nelsonville
Apr. 27	Farmers Market Vendor Workshop	13	Perry County FM Coop	Somerset
Sept 28	Somerset Farmers Market Training	8	Perry County FM Coop	Somerset
June 18	Farmers Market Vendor Workshop	12	Gordon Square	Cleveland

Technical Assistance for Processing

Brand promotions, Market Ready training, and brand workshops have brought a number of new specialty crop producers to become tenants in ACEnet's Food Ventures Center. New products have been developed from local tomatoes, peppers, culinary herbs, fruit and other vegetables. Larry Fisher and Richard Lehman on the ACEnet staff have provided kitchen equipment training, FDA thermal processing, Good Manufacturing Practices and HACCP training during the product development stages. Many of our previous specialty crop tenants continue to come back each year and most have increased their production quantities in 2012 and 2013.

Products produced using specialty crops included: jams and jellies, pepper relish and hot pepper sauce, apple sauce, pestos, tomato sauce, pickles and many varieties of salsas. The diagram to the right is an example from one of our 2012-2103 tenants Karen Powell of how she made her product from 4 varieties of peppers she raises.

Individualized & Brand Training to Access Wholesale Accounts

The brand programs, especially the 30 Mile Meal have had the most impact on increasing farmers access to restaurant, institutions and grocery purchasing. We are seeing the most significant increases in the restaurant numbers both in term of the number of restaurants now sourcing local produce and the overall increase of sales since the 2012 round of 30 Mile Meal promotions this summer. The restaurants include: Village Bakery, Della Zona, Catalyst Café, Casa Nueva, Restaurant Salaam, Kisers's BBQ, Sol Restaurant, Abrio's, Donkey Coffee, OU Inn, Lake Hope Restaurant, O'Betty's Red Hot, Fluff Bakery, Avalanche Pizza, Lui Lui Restaurant, Oak Room, Pigskin, Purple Chopstix, Zoe's, Gigi's and Sloppy Bub's.

More chefs and restaurant buyers are purchasing from the Chesterhill Produce Auction, and the Farm to Table trainings have started to make in-roads with institutional buyers. Ohio University, Hocking College, Federal Hocking School District, in Ohio have all increased their spending on specialty crops. We have also developed new market partnerships in West Virginia for Ohio grown produce at West Virginia University – Parkersburg, Camden Clark Hospital and the Wild Ramp in Huntington.

Specialty crop producers have participated and experienced revenue increases in many of the direct consumer awareness campaign events, ACEnet facilitated in 2012 and 2013 for the 30 Mile Meal and Food We Love brands. Every year, July is celebrated as 30 Mile Meal month and one of the weeks is dedicated to restaurant promotions. Most of the farmers we serve feel they can attribute most of the restaurant sales increases and new connections to this brand program. Brand promotions have routinely been held in groceries and retail stores, area farmers markets, statewide events like the OEFFA conference and at regional food festivals in southern Ohio. Press coverage has been strong throughout the year and 30 Mile Meal programs have been initiated in Licking County and Youngstown in late 2012 and have increased the number of specialty crop farmers, ACEnet now serves. We have begun doing webinars to work with these

regional partners to help them with technical assistance demands from farmers accessing more restaurant accounts.

The Food We Love program continues to be the brand campaign that works best for the groceries and smaller retailers. Placing more local produce is still a challenge, but a number of groceries, natural food stores and smaller retailers have increased purchasing this summer and fall. We are continuing to work with Tiny Footprint and Caito as possible produce distributors for area farmers. ACEnet and Rural Action have coordinated produce distribution in 2012 and 2013 to educational and medical institutions utilizing the Rural Action refrigerated pack truck and an entrepreneur from Morgan County, Dave Taylor to do deliveries for Ohio University and some of the other institutional buyers. In fall 2013 ACEnet and Rural Action secured additional funding to upgrade our Athens, Nelsonville and Chesterhill facilities to provide farmers with better cold storage, aggregation and distribution capabilities. The expansion plans for making a more explicit food hub connection is described in the future plan section. ACEnet has also begun to equip our Nelsonville Incubator facility as a food hub for produce growers. We currently house Vest Berries this fall for storage of winter squash and sweet potatoes.

Goals and Outcomes Achieved:

The best accomplished goals included the trainings on season extension, GAP and Market Ready. The attendees of those workshops had the highest growth in sales and new access to wholesale markets. The value-added trainings had the most benefit to farmers market vendors increasing sales of bottled products and extending weeks at markets.

Although most of the work plan objectives have been completed for this project time frame, ACEnet and Rural Action continues to track annual sales and market access data for specialty crop producers. Data is annually collected for increase in acreage, sales, geographic market reach and types of markets. We also collect information from 30 Mile Meal restaurant partners to measure the number of specialty crop producers they are purchasing from annually.

The measurable outcomes for the project timeframe are the following:

1. 57 specialty crop producers will increase sales by $5,000
2. 52 specialty crop producers by $5,000-$10,000
3. 8 increase by $10,000 to $25,000
4. Increase sales will create 6.5 full time equivalent new jobs
5. 27 restaurant, grocery and institutional buyers increased local purchasing of specialty crops by 10% annually.

The specialty crop producers and restaurants meeting these metrics are listed in the chart below in beneficiaries section. The tracking systems were set-up for the multi-county specialty crop farmers using ACEnet services for this project. See pdf attachment. Attached are producers and market sales for specialty crop producers participating in the funded activities. One chart has

sales information and growth for producers and the second chart tracks buyers information from restaurants, retailers and institutional buyers.

Dave Shull of the Athens Kroger with Farmers Display

Beneficiaries:

The primary beneficiaries were family farmers growing specialty crops in southeastern Ohio counties. Farmers attending trainings and receiving technical assistance numbered 133 from the targeted counties. The Market Ready and 30 Mile Meal brand trainings in Licking, Cuyahoga and Mahoning counties also had farmers outside of the primary counties participate. The chart above outlines the number of trainings and the specialty crop growers who attended GAP, GMP, HACCP, season extension, brand and farmers market vendor trainings.

During the project timeline, ACEnet and out partners provided training to the following farmers organizations and associations: the Chesterhill Produce Auction, the Lake to River Produce Cooperative, the Perry County Farmers Market Coop, the Ohio Farmers Market Management Network, the Ohio Ecological Food and Farm Association, the Wild Ramp Producers Coop, the Athens Farmers Market, the Ohio University Farmers Mini-Market, the Nelsonville Farmers Market, the Gordon Square Farmers Market and the Somerset Farmers Market. Specialty crop producers benefiting from participation in the Athens County, Lake to River and Licking County 30 Mile Meal brand programs grew their access to restaurant and institutional buyers in Ohio and West Virginia.

Lessons Learned:

Our collaboration with area specialty crop farmers, the Rural Action Sustainable Agriculture program, the Chesterhill Produce Auction and the OSU Direct marketing Team has demonstrated the importance of farmers and support practitioners working together to solve the challenges of increased demand for local produce. The 30 Mile Meal brand program and the partnership with the OSU Direct Marketing Team have been effective collaborations to provide training, marketing assistance and branding support to specialty crop producers accessing restaurant, grocery and institutional buyers. Training on season extension and micro-processing has also help farmers extend the options to sell at least 10 months and for many now year-round a range of products that foodservice market channels are interested in sourcing locally.

The biggest challenge for our region is still the lack of infrastructure for aggregation and distribution of refrigerated product. Over the past year ACEnet and Rural Action staff have been designing a sub-regional food hub network plan to upgrade the Chesterhill Produce Auction, the ACEnet Food Ventures Center and ACEnet's Nelsonville Incubator --- a section of which is becoming the Nelsonville Food Hub. Currently, we have secured more packaging and warehousing equipment for the facilities on both the Athens and Nelsonville campuses and have 2 proposals pending for 2014 which would provide funding for processing, packaging equipment, walk-ins and climate controlled rooms. The Nelsonville Incubator renovation of $525,000 from an EDA award was completed by fall 2013 which has allowed us to accommodate more food tenants this fall.

Contract Information:

Appalachian Center for Economic Networks (ACEnet)
Contact: Leslie Schaller
leslies@acenetworks.org
740-592-3854

Additional Information:

During the timeframe of the project ACEnet has assisted in the development of the **Real Food · Real Local Institute** to work with other communities replicating the 30 Mile Meal program. The **Real Food · Real Local Institute** supports the development of local food systems through education, mentoring, facilitation, replication, and collaboration. Institute activities include training and technical assistance, aggregation and sharing of best practices, convening local food practitioners, and assisting in the implementation of successful models. ACEnet and the Institute hosted the annual Real Food, Real Local, Real Good Conference in Athens, Ohio a three to four day convening of local food practitioners, policy makers, food and farm entrepreneurs and community organizations. ACEnet and the Real Food· Real Local Institute are now working with other regions to replicate this successful branding model that expands the production and consumption of fresh produce by specialty crop producers.

Project Title: Increasing the Sustainability and Profitability of Ohio Container Nurseries

Project Summary:
36 woody taxa (a total of 216 plants) were grown (under the standard cultural conditions used at the four cooperating nurseries) in either black plastic containers or in fabric lined wire baskets during the 2012 growing season. The plants were overwintered in place without out winter protection (with one exception) during the 2012-2013 winter and evaluated for survival in May 2013. For most taxa, similar sized plants could be grown in fabric-lined wire baskets as in black plastic containers, despite the reduced container volume of the fabric-lined wire baskets. There were no weed control issues in the fabric-line wire baskets, although no herbicides were applied to the fabric lined wire basket substrate surface. When plants were grown in fabric-lines wire baskets placed directly on a gravel base, rooting out was an issue with some tree species, as it was with plants grown in black plastic containers. Overwinter mortality was minimal for all taxa and container types. Nurseries adopting fabric lined wire basket production could realize significant savings in labor and capital costs (no overwinter consolidating in polyhouses and spring re-spacing was required). Fabric lined wire baskets also reduced the need for herbicide applications to the substrate surface. Using fabric lined wire baskets would reduce the carbon foot print of nursery production by using less fossil fuel products (plastics, gas and diesel) during production making the green industry even greener and increasing sustainability.

Project Approach:
Previous research conducted at The Ohio State University indicated that woody nursery crops could be grown in wire baskets (commonly used in the harvesting of balled and burlapped nursery stock) lined with a non-absorbent polyester fabric. The potential advantages of the new container production system were reduced labor and materials costs and the elimination of protective overwintering polyhouses.

The purpose of this grant was a proof-of-concept study; to determine if fabric-lined wire baskets could be used to grow similar sized plant material as black plastic containers using a variety of woody plant taxa and under different management practices in several climatic zones. Thus, four on-farm trials were installed with the new container system. Also, continued refinement of the system was done at The Ohio State University container research facility in Columbus. In April, 2012 on-farm trials were installed at Klyn Nursery, Painesville, OH, Scarff's Nursery and Studebarker Nursery in New Carlisle, OH and at Decker's Nursery, Groveport, OH. The nurseries represent important nursery production areas in the state and are considered early innovators. The studies included a diversity of woody plant nursery crops. For instance, Klyn's was selected for its northern location and shade and ornamental tree production; Scarff's was selected for deciduous shrub production; Studebaker was selected for deciduous tree and deciduous and evergreen shrub production while Deckers was selected for grafted conifer production (see Table 2 Attached for a complete list of woody plant taxa studied). Nine taxa were grown at each nursery (a total of 36 taxa), with half the plants of each cultivar grown in traditional black plastic containers and half in fabric lined wire baskets, except for Klyn Nursery were an additional container type was added: a wire basket lined with 4" thick un-faced fiberglass insulation. The fiberglass lined container was not included at the other nurseries because that thickness of fiberglass liner significantly reduced the container volume. Also, at Decker's, a 24" wire basket was used instead of a 20" wire basket.

For the fabric- and fiberglass-lined wire baskets (here after denoted as "fabric"-lined wire baskets), the irrigation emitters were placed underneath the fabric after it was gathered around the base of each plant forming a weed-barrier mulch.

With regard to cultural practices, the trials were conducted under the standard cultural practices for each nursery. This presented challenges for comparisons across nurseries because each nursery had unique pruning, fertilization, irrigation and pest control practices. The different container sizes used during the 2012 growing season are listed in Table 2 attached. All plants received about 2 lbs of elemental N per cubic yard of a complete pre-plant incorporated controlled release fertilizer. No two nurseries used the same type of controlled release fertilizer or substrate.

Goals and Outcomes Achieved:
The goals were to determine if similar sized plants types could be grown in the major production areas of Ohio in fabric lined wire baskets as in black plastic containers, to determine the overwinter success of plants without overwinter protection, and to form a network of early adopter nursery producers with the objective of speeding nursery adoption.

Survival was high (100%) at all locations except Klyn Nursery where it averaged (13%; 11 of 81 plants) with mortality equally distributed across container types (5, 5, and 4 for black plastic, fabric-lined wire baskets and fiberglass-lined wire baskets, respectively). The mortality was caused by undetected irrigation emitter clogging. The emitters in the fabric-lined wire baskets were placed below the covering, thus clogged emitters were not detected until plants wilted, or in some cases, died. There were numerous clogged emitters in an adjacent production block which also caused some mortality. However, mortality was limited in the production block because of regular visual inspection of the emitters. The experimental plants were within the same irrigation zone as the production block. The clogged nozzles where caused by unfiltered irrigation water from a surface pond with algae growth. The mortality occurred in late May to early June. When the algae bloom lessened in early June, clogged emitters did not occur. An additional issue was missed tree training activities such as staking the central leader, but this did not affect mortality or caliper growth.

Growth, caliper or growth index, were recorded at six week intervals from April to September. Caliper measurements were recorded for trees, as that is how they are marketed; for shrubs, growth index was calculated by: GI = (height + widest width + narrowest width)/3.

In general, there were few statistical differences in growth between plants grown in the two container types (Table 1 Attached). The statistical differences were: at Klyn's, *Alnus rugosa* and *Parrotia persica* grown in fabric-lined wire baskets had greater caliper (8 and 4 mm, respectively) than those grown in black plastic containers; *Malus* 'Purple Prince' grown in black plastic containers had greater caliper, 8 mm, than those grown in fabriclined wire baskets. At Scarff's, *Cornus* 'Baileys' and *Syringa pekinensis* had greater growth index than those grown in fabric-lined wire baskets (7 and 9 units, respectively), while *Juniperus* and *Thuja* plants grown in fabric-lined wire baskets had greater growth index and height (41 units and 6 cm, respectively) than those grown in black plastic containers. At Studebaker's, *Magnolia* 'Royal Star', *Viburnum dentatum* and *V. prunifolium* and *Betula* 'Crimson Frost'had greater growth index (10, 10 and 7

units) or caliper (4 mm) than those grown in fabric-lined wire baskets. There were no differences in growth at Decker's due to pruning practiced as part of normal nursery practice. Also, in one flush species (conifers), the current season's growth flush is an indication of the production conditions in the previous year. See Figures 1 to 5 for examples of selected plants.

One caution with the data is the small sample size: 3 individual plant replications per location and container type. The slightly smaller size of plants grown in fabric-lined wire baskets could be partially attributed to the differences in container volumes. The estimated substrate volume of the fabric-lined wire baskets was 130 to 215% smaller than a 15 gallon squat or a 20 gallon squat container, respectively (Table 2 attached). Despite the smaller container volume of the fabric-lined wire baskets, plants grown in those containers did not have proportionally smaller growth index or trunk caliper. Thus, similar sized plants could be grown with 30 to 115% less substrate and fertilizer (all fertilizer was pre-plant incorporated) in fabric-lined wire baskets as in black plastic containers. In some cases (*Aluns* and *Parrotia* at Klyn Nursery), plants rooted through the fabric and into the gravel base of the container area. Rooting out did not occur at the other nurseries. Rooting out is not desirable, but could be reduced if plants were grown on weed barrier fabric placed over a gravel sub-base rather than directly on gravel.

Similar sized plants of many taxa could be grown in the three major nursery production regions in Ohio in fabric-lined wire baskets as in black plastic containers, despite the reduced container volume of the fabric-lined wire baskets. Even though no herbicides were applied to plants in fabric lined wire baskets there were no weed control issues in the fabric-line wire baskets. When plants were grown in fabric-lines wire baskets placed directly on a gravel base, rooting out was an issue with some tree species as it was with plants grown in black plastic containers. Rooting out of plants grown in fabric-lined wire baskets can be minimized by placing the plants on weed barrier-covered gravel pad. The network of early adopters was developed by sharing, via email and on-site visits, verbal and written interim and final reports. The early adopters had extant relationships and shared information on the project as a matter of practice.

Additional information regarding the potential cost savings associated with producing plants in fabric-lined wire baskets was requested by the USDA. The approach taken to estimate the potential savings was to gather cost estimates from the cooperators regarding overwintering activities. The cost estimates requested were for: labor for fall consolidation and spring re-spacing and the cost for plastic for covering the overwintering "polyhouses". The cost estimates for an overwintering polyhouse were obtained from Farm Tech (http://www.farmtek.com/farm/supplies/cat1a;ft_high_tunnels_cold_frames.html) and adjusted for the size of the polyhouse used at the nurseries. Also requested were the costs associated with up-canning various sized plants as one benefit of the fabric-lined wire basket system is a reduction in the number of times a plant is transplanted during the production cycle. Typically, plants are up-canned once per year during the production cycle. For instance, seedlings or rooted cuttings are transplanted to 1 or 2 gallon containers, and then from 2- to-3, 3- to- 5, 5- to- 7 and 7 –to- 20 gallon sizes.

Two cooperating nurseries were able to supply cost estimates for the data requested. The capital costs for polyhouses is variable depending on the size and quality of the structure. For this

analysis, the cost of the least expensive polyhouse was chosen. The costs were $2,300 and $4,200 each, the difference was dependent on the size (15 x 120' vs 18 x 200', Table 1) of the polyhouses used. Although relatively, inexpensive, nurseries have many polyhouses. Nursery 1 had 385; nursery 2 had 54 for a total cost of $885,500 and $226,800, respectively. These costs do not include shipping, assembly at the nursery and the cost of wood for end walls and "kick boards". Also, a nursery would not purchase all the polyhouses in one year, but rather purchase them as nursery production expands. The useful life of a polyhouse can exceed 20+ years, so the costs per year of service are low. However, the polyhouse cost is a significant investment for a nursery. The largest nursery in Ohio has over 1700 polyhouses, a capital investment of $3,910,000.

The fall consolidation and spring re-spacing costs are for labor. The cost range from $381 to $600 per house depending on the number of containers per house and the size of the house (Table 1). These annual costs range from $32,000 to $168,000. Nursery 1 uses a 26 x 135' piece of plastic to cover a polyhouse at a cost of $100. They use 3,510 square feet of poly per house or a little over 31 acres of poly per year to cover the 385 polyhouses at an annual cost of $38,500. In addition to the large amount of plastic used, there is also an annual disposal cost as the poly is replaced each year. As mentioned above, if Ohio's largest nursery had polyhouses of similar size to Nursery 1, they would use nearly 137 acres of poly annually.

The cost of up-canning range from $0.99 to $10.50 per plant, depending on the container size (Table 2). The estimated cumulative up-canning cost of producing a 20 gallon plant at Nursery 1 would be $19.81. The actual cost would be less as the up-canning costs includes materials and labor. The smaller sized containers are re-used so the cumulative cost would be reduced by the cost of the number of pots re-used. Added to the annual up-canning cost are the annual overwintering cost. If plants are produced in 20 gallon fabic-lined wire baskets, there would be one up-canning operation: from a 3-gallon plastic container to a 20- gallon fabric lined wire basket, eliminating some of the 3-to-5 and the 5-to-7 up-canning costs.

The use of fabric-lined wire baskets can result in significant savings of labor and materials costs to a nursery, but the "average" savings cannot be calculated due to the lack of standardization within the nursery industry. However, a generalized estimate of the savings from using fabric-lined wire baskets can be made based on the nurseries percentage of overwintering costs, relative to the total gross revenue. The larger nursery (Nursery 1) estimates their overwintering costs at 3 to 4% of the gross revenue; the smaller nursery's (Nursery 2) overwintering estimate is 1.5%. This conservative savings estimate is realized because fabric-line wire baskets can be overwintered without polyhouses.

Table 1. Costs estimates associated with overwintering traditionally-grown container plants from two landscape nurseries.

Item	Nursery 1		Nursery 2	
Number of overwintering polyhouses	385		54	
Size of polyhouse	15 x 120’		18 x 200	
	per house	Total cost	per house	Total cost
Cost of polyhouse	$2,300	$885,500	$4,200	$226,800
Combined cost of fall and spring spacing	$382	$147,000	$600	$32,400
Cost of poly covering	$100	$38,500	$145	$7,830

Table 2. Estimated costs associated with up-canning plants from various sized containers.

Nursery 1.

Item	Number up-canned	Container size	Cost per plant	Total cost
Up-canning labor and materials costs	44,000	3	$0.99	$43,560
	44,000	5	$2.23	$98,120
	4,300	7	$6.07	$26,101
	500	20	$10.58	$5,290

Nursery 2

Item	Number up-canned	Container size	Cost per plant	Total cost
Up-canning materials costs only	15,000	5	$0.35	$5,250

Beneficiaries

The immediate beneficiaries of the study were the cooperating nursery producers. The benefits of lower production costs could be passed on the consumers (as in lower prices) or in increased profitability for the nursery producers. Consumers could benefit from higher quality root systems.

Spring 2013 Supplement: Overwintering Success, Root System Development and Industry Barriers to Adoption

Between May 6th and 7th, 2013, all the plants in the fabric-lined wire baskets were rated as dead or alive and measured for their initial spring growth flush. Plants grown in black plastic containers at two locations, Klyn Nursery and Studebaker's Nursery, were measured as these plants were overwintered outdoors. Plants grown in black plastic containers at the other two cooperators, Decker's and Scarff's Nursery, were overwintered in polyhouses as per traditional industry practices and combined with plants from their production blocks resulting in loss of

identity of the experimental plants. At Studebaker's Nursery two taxa: Pyrus 'Cleveland Select' and Betula 'Crimson Frost' were overwintered outdoors, but heeled-in rice hulls.

Overwinter mortality for plants was low: at Klyn's (the coldest part of the state) 2 *Caragana arborescens* in FLWB and 1 in black plastic containers; 2 *Acer fremanii* in black plastic containers and 1 in fiberglass lined wire basket; 1 *Ostrya virginiania* in FLWB and 2 in black plastic containers; 1 *Carpinus betulus* in black plastic container; 1 *Alnus rugosa* each in FLWB and fiberglass lined wire baskets; and 1 *Perotia persica* in a FLWB; one was one *Pinus strobus* in a FLWB at Decker's; none at Studebaker's and Scarff's grown in FLWB. At Studebaker's 1 *Buxus* grown in a black plastic container was lost. Of the 108 plants grown in FLWB in this study, six died during the 2012-2013 winter, about 6%. The spring growth flush had just begun at the time of evaluation, so the "growth" measure was not a good indicator of the spring growth potential, but an indicator of overwinter survival. At the two nurseries were plants in black plastic containers and FLWB could be compared, there was no difference in the initial growth (data not presented). It should also be noted that for plants in FLWB, there was no discoloration of the foliage in the broad and narrow leaf evergreen taxa. The 2012-2013 was a "good" test winter. There was little snow cover (maximum 5") and it was a colder winter than the new "usual". The minimum temperatures were 5.7, 5.5 and 5.3 F on Feb. 18, Jan. 22 and Jan. 22, for Klyn, Scarffs-Studebakers and Deckers, respectively.

At Studebaker's and Klyn's Nurseries permission was received to harvest some of the plants in the experiment. At Studebaker's *Magnolia stellata* plants were harvested. Magnolias grown in black plastic containers had many surface roots, with the typical concentration of roots at the bottom and sides of the container (Fig. 7a-d all are attached). 7a shows the northwest side of the root ball, while 7b shows the southwest side, which almost devoid of roots. It is common for container-grown stock to have fewer roots on the SW side than other sides due to exposure to the sun, which creates inhibitory temperatures to root growth. In Fig. 7c, an interesting root malformation is seen. Root seems to emerge from the original root ball and when reaching the container-substrate interface, grow upwards and then arc downwards. This malformation would be easily corrected with root pruning at the time of transplanting. Fig. 7d shows the SW side of the root ball with some of the substrate removed, revealing the circling root development at the bottom of the container.

Figure 8 (a-c all are attached) shows Magnolia *stellata* that was grown in fabric lined wire baskets. Fig. 8a is a photo from the NE side of the root ball, while 8b is of the SW. Here the root density is less on the SW side than on the NE side. Fig. 8c shows the root ball with some substrate removed. There is little circling root development and no arcing root malformation.

Figure 9 (a-e all are attached) shows *Alnus rugosa* root balls from Klyn Nursery. Alnus has an aggressive root system and root escapes from the drainage holes in black plastic containers is common (Fig. 9a). There were also root escapes (Fig. 9d) from plants grown in fabric lined wire baskets. Fig. 9b and c show the circling root development at the bottom of the black plastic container. These photos are both of the NE side of the container with 9c being a close-up view. Note the few root tips on the sides of the substrate, even on the NE side. Fig. 9d shows the root escapes from the fabric lined wire basket and the algal growth sometimes found at the base of these containers. Fig. 9e is a photo of the root ball of the plant in 9d. There is one circling root

that has developed at the substrate surface that should be removed before transplanting. The many non-deflected root tips contained in the fabric lined wire basket plant suggest the high potential for rapid root regeneration.

In summary, plants grown in fabric lined wire baskets have fewer root defects than plants grown in black plastic containers. The greater root development on the SW sides of plants grown in fabric lined wire baskets suggests these containers offer a degree of beneficial substrate temperature modification.

Lessons Learned (Sociological):
From a sociological perspective, nursery producers tend to be individualistic. The individualism is manifested in unique nursery practices: different sizes and manufacturers of containers; different substrates; different fertilizer types, application methods and rates; different water quality; and different irrigation practices. Also, Ohio's nursery production areas have unique climates and resources which dictate which plants types can best be grown in their geographical area.

For these reasons, there were confounding effects in the study due to differences in standard nursery practices. Also, the potential for fabric-line wire baskets were being tested against the standard management practices used at each individual nursery for the production of black plastic container-grown plants. If fabric-lined wire baskets were adopted for use, production conditions would be optimized for fabric-lined wire baskets, not black plastic containers. See the Additional Information section for a water use example.

Lessons Learned (Barriers to Commercial Adoption):
The follow are comments offered by the owners and growers of the cooperating nurseries regarding the potential for adoption of a fabric line wire basket and some possible solutions.

Aesthetics: algae will grow on the bottoms of the containers and is especially noticeable because of the white fabric used in this study. An algae hiding color could be used, but the effect of a darker color on root zone heating would need to be research. Relatively speaking, my experience with other fabric containers that are not non-absorbent, is that algae growth is greater with these containers than with the fabric lined wire basket (FLWB). The other aesthetic concern is fabric discoloration when FLWB are placed under overhead irrigation, especially when irrigated with high mineral content water. he FLWB are best used with micro-irrigation emitters placed under the fabric. However, stain from overhead irrigation drift would be an issue, as it would with any other container-growing system.

Market: The FLWB are appropriate for all nursery markets: retail, landscape installation, wholesale and re-wholesale. However, it was voiced that the easiest market penetration would be with the wholesale and landscape installation markets. Consumers may be enticed because significantly less fossil fuel is used in the manufacture and transportation of FLWB than with black plastic containers. However effective consumer education methods for the green industry are not well developed. A plus for landscape installers is the greater easy of transplanting plants grown in FLWB, relative to those grown in black plastic containers. Plants grown in FLWB need less root pruning at transplanting to correct root malformation and can be easily removed from the wire basket. Also, based on estimates, the cost of materials and shipping of FLWB would be

significantly less than black plastic containers due to reduced weight.

Irrigation Monitoring: Micro-irrigation emitters were installed below the fabric in this study. Therefore they are not as easily monitored for clogs and coverage as emitters placed in black plastic containers. In this study, clogged irrigation emitters were first noticed when plants wilted.

Irrigation Volume: FLWB had higher evapotranspiration (about 1/3 higher) than black plastic containers due to higher evaporative surface area. Transpiration rates, adjusted for plant size, were similar between container types.

Nursery Adoption: A nursery manager would need greater experience with FLWB and production optimization before changing from black plastic container to FLWB. One issue in this study was that the FLWB and black plastic containers were under similar irrigation regimes, although FLWB had higher evaporation rates and had lower plant available substrate moisture volume due to smaller substrate volume. Typically irrigation zones contain hundreds to thousands of plants. Thus, changing container types comprises a significant risk for the nursery manager. Due to ease of management, many nurseries continue to use overhead irrigation, despite the greater irrigation volumes relative to micro-irrigation. Adoption of FLWB would require changes in irrigation management. Although labor is saved by overwintering plants "in place", more labor is required during potting. The fabric has to be "stuffed" into the wire baskets before potting instead of separating a container from a stack before potting with black plastic containers.

Fabric Refinement: "Off-the-shelf" fabric was used in this study. The greatest limitation of the fabric was the lack of an UV-inhibitor, which the supplier was not prepared to do. IT would have been a special order item and the project funding would not cover the special order costs. However, in our previous trials, the fabric was still functional after four years. There is opportunity for further fabric development.

Project Title: Recruitment and Membership Program

Project Summary:

The Ohio Christmas Tree Association (OCTA) was able to utilize the USDA grant funds to develop a Christmas Tree Manual as well as conduct Christmas Tree Colleges at several locations around the state. Through the Christmas Tree Colleges, we were able to address 157 people about the how to's to producing Christmas trees.

Through grant funds, OCTA board members worked with Kathy Smith of The Ohio State University as well as others extension personnel to develop an updated manual that will benefit individuals wanting to get into the Christmas tree business as well as assist the well-seasoned grower. A copy of the manual has been provided for review.

Christmas Tree Colleges also provided a vehicle to educate individuals about the Christmas tree industry. Six Christmas Tree Colleges were conducted around the state. The colleges were promoted through extension which provided the association with a new group of potential growers besides just the membership to mentor. The meetings took place at local Christmas tree growers who also served as the presenters.

Each attendee that attended the college sessions were presented a notebook that included information needed to get into the business. We also included a CD that provided beneficial information. (A CD has been provided) The association was able to purchase the videos from Michigan State University. We then hired a videographer to put an Ohio twist on the videos.

Project Approach:

The grant was originally designed to have the growers write the manual so that the information provided was in general terms so that anyone could understand. But after meeting with the extension representatives, we realized that they would need to write the manual because of technical issues. By utilizing extension personnel to write the manual, we now have a tool that will benefit the Christmas tree industry in Ohio and other states that grow Christmas trees.

Goals and Outcomes Achieved:

Through the Specialty Crop Grant, we were able to obtain an updated Christmas tree manual which will be very beneficial for those wanting to get into Christmas tree production. This is a great production vehicle and will aid those already in the business as well.

Our mentorship program continues to grow through this grant as well. The Christmas Tree Colleges have given the association the opportunity to meet with individuals that are interested in getting into the business. It is our hope that we can continue with this program by working with the extension personnel.

The video was distributed in the notebooks to the 157 that attended the college session. At the time of the sessions, the manual was not available. The manual can be purchased through the OSU Extension.

The goal of this grant isn't to promote membership but to increase the number of Christmas tree growers in the state. It is our hopes that the video will help to educate growers on what it takes to produce a Christmas tree rather than just plant trees and wonder why they died. New growers also need to realize that it takes approximately 8 years to begin to get a return on your investment. The Christmas tree manual is a great contribution to the Christmas tree industry in the state of Ohio. It replaces a manual that is over 20 years old. This manual is well written by extension experts and has great pictures to provide additional support. OCTA will continue to offer Christmas tree colleges because this is a great way to meet those interested in the field of Christmas tree production. The association will continue to work with organizations to promote the industry thus coming in contact with future growers.

At this time we are seeing interest in the industry through our Christmas tree colleges that have been conducted. We also continue to see new contacts at our winter and summer meetings. Through our meetings we are gaining 3-4 new memberships each year; however the grant wasn't to increase membership but rather new growers. Our goal is to recruit new growers through the educational sessions along with using the Christmas Tree Manual as an educational vehicle to encourage people to get into the industry.

A copy of the manual was provided to the ODA with this report. We aren't providing any of the info as a link at this time. A copy of the video was sent to the ODA with our report. At this time we do not have any link to the video any place. Copies of the manual and video are also being provided to USDA via USPS.

Beneficiaries:
It is OCTA's hopes that the Christmas Tree Manual will be a benefit to all potential and current growers in the state. The manual is such a great educational tool and is well written. OCTA will continue to promote the manual to the membership and at all future 'college' sessions. The manual will also be an educational tool for not only Ohio but other states that grow Christmas trees.
It is the goal of the association that we continue to hold the Christmas Tree Colleges. This is a great vehicle to utilize the knowledge of the current growers, promote the industry and meet potential new growers.

It is the hopes of the association that we can promote the benefits of being in the business because we are an industry of aging growers. It is important to educate individuals that this is a business that takes up to 7-8 years before you get a return on your investment.

Lessons Learned:
Working together with extension and our members, we were and will continue to promote the Christmas tree industry. The colleges have given us the opportunity to come in contact with over 50 potential new growers.

Contact Information:
Valerie Graham
Phone: 740-828-3331
val@ohiochristmastree.com

Project Title: OPGMA Produce Marketing Agreement

Project Summary:
Initial Purpose of the Project:
OPMA is a science-based food safety program that encompasses a three-tiered certification approach and incorporates the development of Good Agricultural Practices (GAPs) for the different produce segments, production environments, and farm cultures that can be found in Ohio. The goals of the proposal were to:

- Vetting standards and compliance processes through beta inspections.
- Complete certifying body requirements in accordance with ISO 17065.
- Complete the business plan to produce a self-sustaining organization.
- Obtain official/legal recognition of OPMA within Ohio Market OPMA to produce buyers.

Importance & Timeliness:
The significance of a safe food supply, one that is free of human pathogens, is highlighted by the fact that the Food & Drug Administration is getting closer to finalizing the parameters for and establishing the Food Safety Modernization Act. Even with the coming of FDA's FSMA, OPMA remains relevant to large and intermediate sized Ohio growers as they seek to ensure and certify the safety of the produce that they grow. Not only OPMA is a recognized ANSI ISO 17065 audit scheme, but OPMA has the flexibility to incorporate parameters of FSMA that may not currently be a part of OPMA. Just as important is that OPMA makes provision for the certification of small growers that FSMA exempts. The FSMA exemption for small growers is a double edged sward. It saves the growers from the anticipated hefty expenses associated with meeting FSMA requirements, but conversely small growers still need to certify the produce they grow. OPMA provides a legitimate and economical venue for certification of small growers.

How Does Project Build on Previous Efforts?
OPMA builds on the project's previous year's efforts, which included:

2009 Grant Year: Summary of Work Effort

- Listening sessions, interviews, and resources gathering.
- Marketing Agreement infrastructure development, technical review board organization, and fact finding.
- Data gathering covering diverse agricultural farming methods in Ohio.
- Initial Marketing Agreement development, including certification tiers, standards, and potential legal structure.

2010 Grant Year: Summary of Work Effort

- Core standards research and development.
- Legal development of the Marketing Agreement.
- Infrastructure development through ISO 17065, Certifying Body Rules and Procedures Quality Manual.

Project Approach:
Completed Project Activities:

- Three beta inspections have been conducted by Dr. Karl Kolb:
  1) Haus Cider Mill, LLC, 25 September (Tier III)
  2) McMaster Farms, LLC, 24 September (Tier II)
  3) Hidden Hills Orchard, 24 September (Tier II)
- OPMA audit process has been submitted to ANSI for ISO 17065 recognition.
- A business plan by which OPMA be a self-sustaining organization has been developed.
- The Ohio Farm Bureau Federation (gratis - the grant covered NO OFBF costs) was instrumental in drafting legislation for voluntary marketing agreements (e.g. OPMA) that was passed by the Ohio legislature and signed by the governor. In accord with the legislation, signatures have been collected in support of OPMA and ODA has called for public comment.
- The marketing of OPMA to producers has included Ads in trade magazines, direct mailings, and marketing at industry trade meetings. Marketing to produce buyers has included meetings with the Kroger Co. In addition, OPGMA/OFA is part of the Food

Safety Coalition and shares the value of OPMA with other coalition members including the Ohio Grocers Association and the Ohio Restaurant Association.

Continuing Project Activities:
A public hearing has been scheduled by ODA January 3, 2014 that will lead (or not) to the official state of Ohio recognition of OPMA.

Goals and Outcomes Achieved:
While not all of the beta inspections anticipated were conducted, those that were sufficient to vet OPMA standards and compliance processes. In addition, OPMA is a recognized audit scheme under the certification authority of Ceres Certification, International, an ANSI ISO 17065 approved registrar. While official state of Ohio recognition is not a certainty, it is expected very soon.

Beneficiaries:
The beneficiaries are the thousands of farms that could participate in the program and their customers. We hear that the Agreement is encouraging farms to improve their food handling practices regardless of their participation in the Agreement. In other words, this program is providing the encouragement necessary for farms to undertake the exploration of their practices. In addition to consumers, the principal eventual beneficiaries of this Specialty Crop Block Grant are the 2,000 to 3,000 small and many of the approximately 2,000 medium sized Ohio produce growers that supply local and intrastate food supply; including restaurants, farm markets, farmers' markets, CSAs, local grocers, etc. The Ohio Produce Marketing Agreement (OPMA) structure and process is set and official recognition of OPMA by the Ohio Department of Agriculture is expected shortly; all that remains is for the wording of this voluntary marketing agreement to be finalized and document to be signed by the director. While current direct grower beneficiaries, i.e. those who currently hold OPMA certification, are few the "mechanism" is in place for OPMA to very quickly provide all small and medium sized Ohio produce growers a vehicle to lend credence to their food safety efforts and help protect Ohio's food supply.

The beneficiaries of this effort are Ohio growers and consumers.

Lessons Learned:
We have learned that it takes multiple attempts to make change in the farming community. While food safety is a critical issue it takes lots of time for people to understand the opportunities and then change their behaviors to meet the standards. Furthermore, not everyone appreciates the influence of the Agreement or the association on the farming industry. Furthermore, our messaging, whether it's marketing or educational in nature, must be plainer spoken to appeal to a very broad audience. However, we have learned there are many farms that are eager to improve their practices and they wish we could support them beyond the current level of programming.

As suggested in the previous question, despite the urgency to improve food handling practices it has been very difficult to enroll farms. Many are not eager to sign on to institutional or formal solutions. Further, many are not as connected to our communications channels as we believed. In

the early planning stages of the program we anticipated we would not be able to meet the demand yet it's been quite the opposite. We have learned that people are readily open to change and that, surprisingly, unless government insists on transformation they are slow to act.

Our marketing budget was not sufficient to promote the program. The fact is that the physical farms and the farmers themselves are not as connected to the Internet as we thought. Email promotion, while practically free, is not ideal for this community. More direct mail and in-person engagement would have helped. Furthermore, utilizing more opinion leaders to share the story of food safety and the value of our program would have been beneficial, especially for the Amish and Mennonite communities.

Contact Information:
Michael Geary mgeary@ofa.org
Steve Carver, PhD, scarver@ofa.org
David Savoia dsavoia@ofa.org

Final Report – Approved December 2012

Project Title: OPGMA Food Safety Outreach Education

Project Summary:
As stated in the proposal, the project builds on previous submissions with additional outreach to Ohio growers who have not participated in previous activities. There are thousands of produce growers in the state of Ohio, connecting with and educating them through our various venues is a never-ending effort. Furthermore, we met the following objectives:

1. It provided updates of both USDA and FDA food safety efforts and of Ohio Produce Marketing Agreement (OPMA) development status.
2. It provided a three-hour intense food safety seminar with updated material.
3. We included a program on marketing the value and necessity of food safety, presented by a marketing expert. The session focused on creating an understanding of and an urgent need for food safety best practices and certification efforts by farmers in order to protect the safety of Ohio-grown produce and ultimately the consumer. Additionally, improved marketing efforts increases the vitality of the Ohio industry and individual growers, in particular.

The public perception of fresh produce has historically been that it is good, wholesome, and safe. Continuing incidences of food-borne pathogens found on domestically grown and imported produce causing illness and even death, has shaken this perception and drawn increased wariness and scrutiny of our food system. The food safety training offered during the 2012 Ohio Produce Growers & Marketers Association Congress (the OPGMA Congress is the annual convention for Ohio's fruit and vegetable growers, packers, and marketers), augmented with training during the 2012 OPGMA Summer Tour & Field Day and articles in the OPGMA Today Newsletter, provides Ohio growers with the grounding needed to help them avoid being the source of food borne safety risks, and document their production and

distribution practices when problems do occur.

The 2011 Ohio Specialty Crop Block Grant effort built on previous years' efforts in several ways. First, it increased the total time devoted to food safety education – from 6.25 hours the previous year (2011) to 7 hours in 2012. Like the 2010 grant, the 2011 grant facilitated the incorporation of Ohio State University (OSU) researchers and educators into the OPGMA Congress education program. Finally, it exposed attendees to the standards and mechanics of a food safety certification effort, using OPMA as the exemplar. New to the 2012 Congress program was the renewed and overt effort to help producers understand their critical role and responsibility in ongoing efforts to protect our food supply.

Those directly involved in the food safety efforts at Congress, Field Day and in newsletter articles included: Bob Jones, The Chef's Garden Inc; Karl Kolb, PhD, High Sierra Group; and Hal Kneen, Mark Koenig, Ashley Kulhanek, Jeff LeJeune, PhD, Robert McCall, OSU; Patrick Trail, T3 Technologies Inc; Aaron Buurma, Buurma Farms; and John Stanley, John Stanley Associates.

Project Approach:

- OPGMA hosted four sessions (a 45 minute keynote, 60 and 75 minute sessions and a 4-hour seminar) at the 2012 OPGMA Congress. Total attendance was 375, representing several hundred operations.
- Almost 200 individuals attended the 2012 OPGMA Summer Tour & Field Day event during which they heard an extended explanation of food safety practices at one of the largest vegetable production operations in Ohio.
- Food safety articles, written by Dr. Karl Kolb, were published in the Winter, Spring, Summer, and Fall issues of the OPGMA Today newsletter. This publication is distributed to universities and hundreds of farming and packing operations.
- There were not problems or delays in implementing the planned efforts supported by this grant.

Goals & Outcomes Achieved:

Attendance to the four food safety sessions offered at the 2012 OPGMA Congress (held in January) totaled 380 individuals. To improve the correlation between pre and post program understanding of food safety issues, we opted for onsite pre and post surveys rather than following up the program with an online post survey. OPGMA Congress food safety session attendees were asked whether they had a better general understanding of food safety issues at the close of each session than before it started. We then asked respondents to rate their level of understanding of the 3 specific topics listed above both before (pre) and after (post) the session on a 5 to 1 scale (5 = very knowledgeable, 1 = just starting to learn). The 105 of 111 respondents said yes, they had a better understanding of food safety issues in general and of the 3 topics in specific at the close of a session:

- Core Food Safety Concepts avg ratings: Pre = 3.0; Post = 4.0
- How to Implement GAPs: Pre = 2.6; Post = 3.7
- OPMA & Certification: Pre = 2.3; Post = 3.7

Approximately 200 produce growers attended a tour of Buurma Farms, one of the largest produce farms in Ohio with satellite produce farms in Michigan and Georgia, during the 2012 OPGMA Summer Tour & Field Day. The tour included a display of some of their food safety equipment as well as their strategies given by both their food safety director and consultant.

We reached 375 industry stakeholders during the 2012 OPGMA Congress, another 200 during the 2012 OPGMA Summer Tour & Field Day, plus 400 member stakeholders through our printed OPGMA Today newsletter and e-newsletters. Combined, these stakeholders represent hundreds of farming and packing operations, and marketers in Ohio.

Fifty-three individuals attended the 4-hour seminar titled Food Safety Training & Education. This session was presented by the OSU faculty; the seminar description: "The OSUE Fruit and Vegetable Safety Team will share produce safety and good agricultural practices (GAPs) for farms, including issues surrounding water, soil, handling, and traceability. Workbooks will be provided that include information on beginning risk assessment of produce safety on the farm. Updates on the most recent research and progress of the FDA Food Safety Modernization Act will also be presented. This session is open to all at no cost."

Those completing the 4-hour seminar received a certificate of completion. The instruction supplied during the seminar serves as an education foundation for all three tiers of the OPMA food safety certification program, and meets the criteria for those who will apply for a Level 1 (local retail, i.e., farm markets, farmer's markets, etc.) OPMA certification. Furthermore, this education supports other GAP certification programs and, most importantly, expressed the increased need for producers and handlers to give food safety a greater priority in their operations.

Beneficiaries:

A direct measure of the potential economic impact of this projection is not available but two recent incidents illustrate the potential in general terms. The first is food borne illness associated with cantaloupes last year that caused untold suffering and the litigation against and bankruptcy of the Colorado grower to which the problem was traced. No public food safety issues have yet been attributed to any Ohio produce growers – the education facilitated by the grant gives growers the understanding to implement the strategies and procedures needed to help keep the food they produce safe, protecting the consumer as well as themselves. Second, we received an email just yesterday from a blackberry grower who wants to expand from selling locally via farm markets to sell through a broker who is requires GAP certification. The education facilitated by the grant serves as a foundation for understanding GAPs in general and the kinds of measures and strategies needed to become certified. So, not only is the grant helping to avoid the economic loss associated with food borne illnesses but it helps to create economic opportunity for some produce growers. The beneficiaries of this effort are Ohio growers and consumers.

Lessons Learned:

Growers respond to, or at least are willing to listen to, the call for food safety protocols, especially when that message is mixed with that of the tangible and intangible pay-backs. We had over 225 attendees at the keynote message titled, "Making Food Safety Work for You & Your Wallet," We also learned from session evaluations that many growers are looking for more advanced training than that received during the four hour seminar presented by the OSU researchers and educators. Finally, while more advanced training is requested, we learned that 105 of 111 food safety session attendees who responded a survey indicated that they had a better understanding of core food safety concepts, how to implement GAPs, and the need for and process of certification.

Contact:

Michael Geary; mgeary@ofa.org
Steve Carver, PhD; scarver@ofa.org
David Savoia; dsavoia@ofa.org